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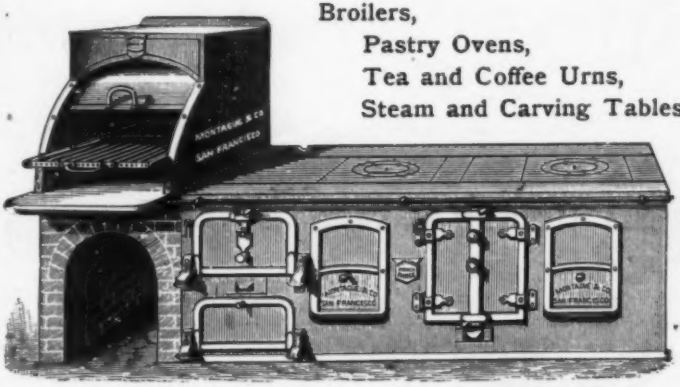

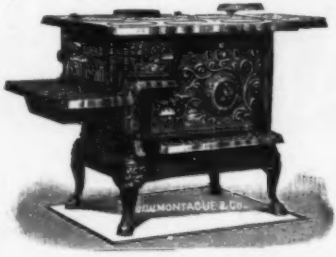

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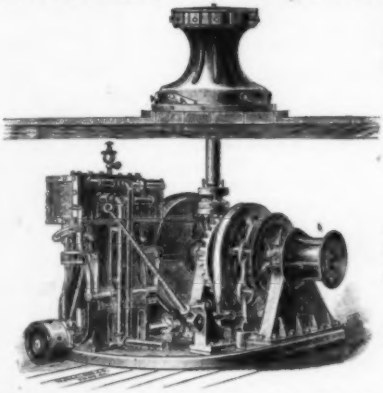

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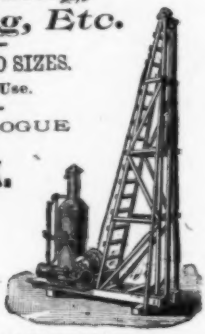

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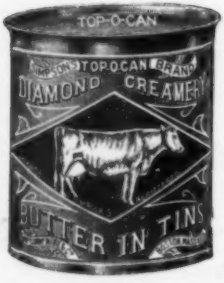

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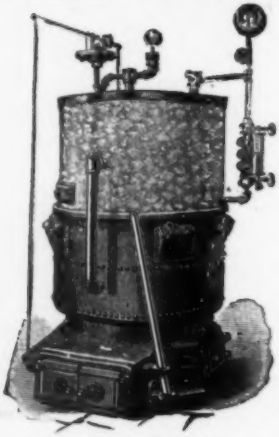

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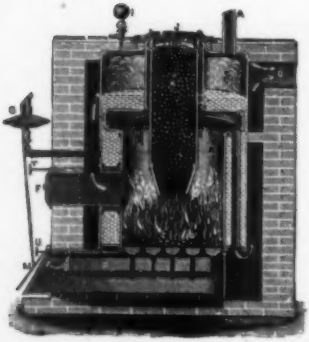

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VOL. XIV. JANUARY, 1893. NO. LXI.

THE ARTILLERY SERVICE IN THE WAR OF THE REBELLION, 1861-65.

BY BVT. BRIG.-GEN. J. C. TIDBALL, U. S. ARMY.

(*Continued from* JOURNAL *No. 60.*)

VII. CHICKAMAUGA (*Second day*).

WHEN Brannan's Division was withdrawn from the left of Baird's, as heretofore stated, Dodge's Brigade of Johnson's Division was sent to replace it. This brigade now constituted the extreme left of the Federal line, and from this around to the extreme right the divisions stood in the following order:—Baird's, Johnson's, Palmer's, Reynolds', Brannan's, Negley's, Davis', and Sheridan's; those of Van Cleve and Wood were in reserve in rear of the right centre. The first five constituted the left wing under Thomas; the remainder the right wing, nominally under McCook.

Opposite this line, in the woods that had been fought over during the previous day, lay the enemy about half a mile distant. His line, from right to left, consisted of the following divisions: Breckinridge's and Cleburne's of D. H. Hill's Corps; Gist's and Liddell's of Walker's Corps; and Cheatham's of Polk's Corps. These constituted the right wing under Lieutenant-General Polk. The left wing under Lieutenant-General Long-

street, consisted of Stewart's and Preston's Divisions of Buckner's Corps; Bushrod R. Johnson's and Hood's of Hood's provisional corps; followed by McLaws' of Longstreet's Corps, and by Hindman's of Polk's Corps on the extreme left.

In addition to the foregoing, Forrest had his corps of cavalry, consisting of two divisions, on the right, where, during the battle of both days, he was exceedingly active and enterprising. Dismounting his men to fight on foot, they became efficient infantry, and were in fact the only troops that Brannan and Baird had to contend with for a considerable period on the forenoon of the first day.

The Federal cavalry was on the right and left doing good service in guarding the flanks.

Bragg adopted the same plan of battle for the second day that he had tried for the first, viz.:—General Polk, commanding the right wing, was ordered to assault the Federal extreme left at day-dawn, and to take up the attack in succession rapidly to the left. The left wing, under Longstreet, was to await the attack of the right, take it up promptly when made, and then the whole line was to be pushed vigorously and persistently against the enemy throughout its whole extent.

Polk was not himself present, nor did he have his troops in readiness for the attack until long after the appointed time, in fact, not until about half past eight o'clock.

Meanwhile the Confederates made a reconnoissance around the Federal left and across the State Road "proving the important fact," says Bragg, "that this greatly desired position was open to our possession."

General Thomas, fearing for the weakness of his left, made a request early in the morning for Negley's Division to take post on the left of Baird. Rosecrans ordered that Negley's place in line should be filled by Wood's Division. Through delays most unaccountable, this was not done until about 9 A. M.; but about an hour before this time one of Negley's brigades—that of John Beatty—had been dispatched in all haste, and arrived just as the enemy was moving to the assault. He at once became hotly engaged, and this was the commencement of the momentous battle of the second day.

The addition of Breckinridge's Division to the right of Cleburne's greatly outflanked Thomas' left, now held by Beatty whose brigade was greatly attenuated to cover as much ground

as possible. Still further on, Forrest, with a division of dismounted cavalry, was working his way around to Beatty's rear. This overwhelming force soon broke and scattered Beatty's regiments and captured two of the guns of Bridges' Illinois battery attached to that brigade. The lieutenant commanding them was killed.

After Beatty was broken the attack fell upon Baird's Division, throwing King's brigade of regulars into disorder, which extended to the adjoining brigade of Scribner. It will be remembered that in the battle of the previous day Baird's batteries had suffered so severely that he had but four pieces for the whole of his line; these were placed at that point where his line began to come back towards the State Road. The troops on the remainder of his line were therefore without either the physical or moral support of artillery.

By this time the tardy movements on the right had permitted Negley to send another of his brigades—that of T. R. Stanley—to the assistance of Beatty, who had succeeded in rallying some of his regiments. Notwithstanding the great inferiority of their numbers, these troops checked the enemy. Meanwhile Grose's Brigade of Palmer's Division, Van Derveer's of Brannan's, and Dick's and Barnes' of Van Cleve's Division, were hurried to the left, and joining in the fight effectually repulsed Breckinridge and Forrest.

The brigades sent to the left, or at least some of them, were those lying in support of divisions on the line, and were thus in a measure available. As a rule, each division had two brigades in line and one in support. There was no reserve division: the reinforcing of any part of the line, therefore, meant the weakening of some other part.

Grose's brigade was accompanied by Cushing's battery "H," 4th U. S. Artillery, which, as usual, did splendid service, until the ammunition in its limbers was expended, when being relieved by Russell's,—"M" of the same regiment,—it withdrew to replenish from its caissons. After this, Cushing was ordered to take position, with other batteries, on Dyer's Hill, an eminence directly in rear of that part of the Federal line struck by Longstreet's charge which swept everything before it. Here Cushing lost one of his pieces, by the disabling of his horses.

The battery of Van Derveer's Brigade—Smith's "I," 4th U. S. Artillery,—did not accompany its brigade, being about that

time sent to Snodgrass Hill where it took position and continued to the close of the battle doing most effective work.

Dick's Brigade was accompanied by Swallow's battery, but before reaching its destination it was recalled and placed on Dyer's Hill, where it, also, lost one piece. Dick's Brigade, upon meeting the enemy, was broken in two: one portion retired to Snodgrass Hill where it did good service; the remainder joined a body of troops that Negley collected and conducted from the field.

When Barnes started for the left, his battery,—Livingston's Wisconsin,—being unable to follow him directly, on account of the woods and other difficulties, was sent to Dyer's Hill where five of his pieces fell into the hands of the enemy. This brigade continued on the left during the remainder of the day.

Schultz's Ohio battery, which had attempted to accompany Stanley's Brigade, became separated from it and did not rejoin it during the day, but became one of those subsequently conducted ingloriously from the field by Negley, as will be mentioned further on.

Negley's third brigade,—Sirwell's,—arrived too late to assist in the repulse of Breckinridge. Together with most of the regiments of Beatty's Brigade, it, with the exception of one regiment, was gathered up by Negley and marched from the field. Marshall's Ohio battery, attached to Sirwell's Brigade, had the same experience as had Schultz's. Both of these batteries however managed to get in a few shots, which no doubt contributed towards the repulse of Breckinridge and Forrest.

Thomas, perceiving the imminent danger of his left and rear, being himself an old artillerist and knowing the value and proper use of that arm in strengthening an unprotected flank, directed General Negley, who had now himself arrived on that part of the field, to "mass as much artillery on the slopes of Missionary Ridge, west of the State Road, as he could conveniently spare from his lines, supported strongly by infantry, so as to sweep the ground to the left and rear of Baird's position." Negley set to work most energetically and soon had collected seven full batteries and some parts of others, in all 52 pieces; but mistaking the purport of the instructions given by Thomas, took them, together with such infantry as he could collect, in a direction directly opposite to that intended, and posted them on Snodgrass Hill, a prominent spur of Missionary Ridge extending down in rear of the right of Thomas' wing.

Thomas had no officer of artillery to whom he could intrust the duty for which he thus took a division commander, and as the latter himself had none, he had to neglect his brigades to attend to the work in person; a direct result of the artillery system, or want of system, that prevailed in that army. What became of the infantry and batteries collected by Negley will appear further on.

It was only by the most determined fighting that the bold attacks of Forrest and Breckinridge were repulsed; but the repulse was decisive and followed up until the enemy were beyond the position from which they started in the morning. While being forced back, the brigades of the enemy would turn and, for a time, drive back their adversaries. In this way the ground was fought over, back and forth, several times.

Following soon after the repulse of Breckinridge came the furious assault of Cleburne's Division. This fell principally on Johnson's Division and the right brigade of Baird's Division; all behind breastworks and well supported by artillery. The repulse that ensued was very sanguinary to the assailants, who were followed up by skirmishes from the main line.

Upon the repulse of Cleburne, the divisions of Gist and Liddell of Walker's Corps were pushed into the fight, but they too, failed to break the Federal line. At the same time Cheatham's powerful division of 24 regiments took up the fight on the left of Walker, his assault falling principally on Johnson and Palmer, whose troops, sheltered behind their extemporized breastworks, received the assaults with coolness and delivered their fire with deadly accuracy.

Meanwhile Breckinridge had rallied and, swinging still further around to his right, was coming squarely up on the rear of the Federal line. Just at this critical moment Van Derveer arrived with his brigade and scattered the enemy to the rear, following him up until entirely clear of the field. Grose's Brigade followed soon after Van Derveer's, and drove back a portion of Walker's troops that had got temporary lodgment on the left of Baird's position.

While these things were transpiring on the left of Rosecrans' line, other events to be more particularly noticed hereafter, were happening on his right. Longstreet's first movements against this wing were eminently successful, but after this his operations were a series of assaults upon a new line formed on Snodgrass

Hill. To relieve him as much as possible Polk was ordered at 3 P. M. to make another attack along his whole line. This chief attack was to be another turning movement around Thomas' left, which was now greatly weakened by the loss of the troops conducted away from it by Negley. Here he massed the divisions of Breckinridge and Liddell, and Armstrong's Division of dismounted cavalry, with a number of batteries of artillery. The remainder of Polk's troops were formed to assault the breastworks occupied by Baird, Johnson and Palmer, and with these were brought up as many batteries as the wooded nature of the country would permit.

Liddell's Division struck Baird's line behind breastworks and was repulsed; but Breckinridge, sweeping farther around to his right, was rapidly gaining Baird's rear. At this moment it seemed as though Bragg's plan of breaking the Federal left and rolling it back upon the centre and right was upon the point of success. But most opportunely aid came from Johnson's Division on the right of Baird. Willich's Brigade of this division was lying in support near the Kelley house, and with it was Goodspeed's battery. These at once changed front and engaged the enemy. The fire of the battery was especially good and temporarily checked the enemy. Other troops uniting with Willich, Breckinridge was again repulsed.

The artillery of the enemy did good firing but was invariably driven back by its opponents. One of the Confederate commanders,—Colonel Benjamin J. Hill,—speaking of these efforts, says:—"This artillery did noble service in helping dislodge the enemy from his first line of fortifications, dealing out destruction at every discharge. They did noble service until they exhausted their ammunition. During the progress of this artillery duel, my negro boy having failed to bring up my sword, I took a pole or club and with this drove up officers and men of my own command who were shielding themselves behind trees, as well as those on the left of the left regiment of Jackson's Brigade." After several repulses it became impossible for even the most desperate of the Confederate commanders to bring their troops up to confront the breastworks.

The whole of Polk's wing was now repulsed for the second time, but immediately commenced to brace up for another advance, which took place just at twilight when Thomas' troops were vacating their lines.

Barnes' Brigade remained near Baird's position, as did also Van Derveer's until about 4 P. M. when the latter went to Brannan's assistance on Snodgrass Hill. Grose's Brigade rejoined its division—Palmer's—on the line; the other detached brigades followed Negley.

The Confederate commanders who were repulsed attributed their want of success to lack of generalship on the part of Polk, who caused the attacks to be made in succession and without reserves to strengthen weak places, or follow up success.

Polk's methods lacked generalship; they were almost imbecile. Instead of massing his troops in a solid column of attack to fall with irresistible weight upon Rosecrans' exposed flank, he stretched his line out until its strength and offensive power were lost by attenuation; and as its end swung around to envelop the Federal flank it became itself a flank in the air. Had his troops been massed, as were those of Longstreet, to strike Thomas squarely in flank, that wing would inevitably have been broken, and the whole of Rosecrans' line rolled back upon itself, to the destruction of his entire army.

The front of Thomas' position with a short returning flank was covered with temporary breastworks which the enemy reached around. Here he was met, not by a solid division, but by detached brigades hurried from other parts of the line. These brigades had no common commander but each fought independently.

Negley, a division commander, who was to have commanded, mistaking his orders, appeared among them only to conduct a portion of them away. The success attending this part of the battle was, upon the part of the Federals, simply phenomenal.

The comparatively small loss among the troops who were sheltered by breastworks, as against the terrible slaughter of their assailants, attests the value of such works for a defensive position.

While these events were in progress on the left of the Federal army, other and still more momentous events were transpiring on the right. The operations, as to their plan and execution on both the Federal and Confederate side, were of a character almost diametrically opposite, as were also their results. Polk's efforts were, as we have seen, a succession of attacks, each in itself insufficient to make a decisive impression; at the close of the contest Thomas' lines were as intact as at the beginning.

Longstreet, on the contrary, formed a powerful column of

attack, flanked on each side by a heavy division, the whole of which he pushed forward simultaneously and swept the Federal right wing from the field of battle.

In Thomas' wing every division, brigade and battery was in its proper position ready for the attack; in the right wing nothing was in readiness. During the night the divisions of Sheridan and Davis had been moved off to the right and rear, each separated from the other and both from those of the main line. The divisions of Wood and Van Cleve, of Crittenden's Corps, were massed together some distance from the line. That of Negley was, in fact, the only one in line. Immediately after daylight Rosecrans gave orders to have these errors and omissions corrected, but everything moved slowly. Negley was withdrawn, as before stated, to assist Thomas on the extreme left, and Wood took his place in line, but so tardily that it was not until the turning movement of Breckinridge had well progressed that his brigades reached that critical point. Two brigades of Van Cleve's division were sent upon the same duty. Davis had got his two brigades in line and was closing in to fill up a gap on his left when the crash came. Sheridan, now a considerable distance from Davis, had just received orders to hasten with two of his brigades to the extreme left of Thomas' wing, and had barely started when he had to wheel into line to meet the attack of Longstreet.

Rosecrans was at this point of the line giving personal attention to many details and urging promptness on all those about him. McCook and Crittenden were there also, giving directions. Notwithstanding so many commanders, there was great delay in preparing for the blow which every one could see might come at any minute. Fortunately Polk's tardiness in making his attack on the right delayed Longstreet who, before making his attack, was to wait for Polk to commence his movements. Even after this delay of over four hours the troops of Rosecrans' right were unprepared.

The amount of marching that was done during that night and early morning by the right wing would have placed it bodily on the left of Thomas, thus covering the ground to Rossville Gap, that most desired by the enemy. Thomas' right would then have rested on Snodgrass Hill, as it did after the right wing had been swept away. Bragg's plans would have been disarranged and the condition of things with Rosecrans so much improved as almost to assure him of success.

The command of Longstreet consisted of the divisions of Stewart, Preston, Bushrod Johnson, Hood, McLaws and Hindman, containing, actually present, 17 brigades of 84 regiments, and 21 batteries of about 84 guns. Opposed to these were the divisions of Reynolds, Brannan, Wood, Davis and Sheridan, and one brigade of Van Cleve's; making in all 12 brigades of 49 regiments and 12 batteries of about 60 guns.

Longstreet arrived late in the night of the 19th. Soon after daylight next morning he started to see his command, which he at once set about putting in shape for the work of the day. This he did by forming in his centre a powerful column of attack, under Hood, his reliable lieutenant, consisting of three divisions, each behind the other in line of battle. The first line consisted of Bushrod Johnson's Division of three brigades and two batteries; the second of Hood's Division of three brigades under Law. This division had just arrived from Virginia, and its batteries were not yet up. The third line consisted of the two brigades of McLaws' Division, then commanded by Kershaw, also from Lee's army, and without batteries.

It will be observed that these formations took place only a few hundred yards in front of the Federal line, but so screened from it by dense woods and the hilliness of the ground as not to be observable from it. Indeed when going into position many of the brigades of Hood's divisions did not themselves realize the formation of which they were being made a part. A thick line of skirmishers kept back the Federal skirmishers and prevented them from finding out what was going on. In this connection it may be remarked that a great deal, in fact, most of the fighting of this battle, was done, so to speak, in the dark. Neither contestant could see much of the other, but usually burst most unexpectedly out of the woods upon his opponent.

On the right of the leading division of Hood's column was Stewart's Division of Buckner's Corps, consisting of three brigades and four batteries; while on the left of the column was Hindman's Division of Polk's Corps, of three brigades and three batteries. The divisions were formed with two brigades in the front line, and one supporting, where there were three brigades. Preston's Division of Buckner's Corps, of three brigades and three batteries, was held in reserve in rear of Stewart.

Longstreet, fresh from Gettysburg, where he had witnessed Lee's mistake in sending a small force to do the work of a much

larger one, seemed not disposed to leave anything to chance, but to make the assaulting column irresistible. His superiority in numbers enabled him to do this.

In addition to the batteries accompanying divisions, Longstreet had two battalions of reserve batteries, all of which were brought into requisition during the day, so far as the wooded and broken nature of the country would permit.

Bragg's plan of battle had not progressed as anticipated. Polk's attack upon Thomas' wing was signally repulsed, and Longstreet was directed to attack without delay. It was now 11 o'clock, Longstreet started forward his entire line; Stewart's Division on the right, Hindman's on the left, with Hood's powerful column in the centre. The centre of the leading division of the column struck the Federal line at the right of Wood's position, or rather of the position which he had just left; for it so happened that at the moment Hood started forward Wood received an order from Rosecrans to "close up on Reynolds as fast as possible." As Brannan was between Wood and Reynolds this could not be executed literally, and only constructively by Wood's withdrawal from the line and passing to the rear of Brannan. This Wood did, thus leaving a gap in the line, and through it Hood's column passed with but little opposition. Striking this opening by the enemy was a mere coincidence. The enemy knew nothing of Wood's movement, or of the opening until he emerged from the woods into the narrow field in front of it.

Davis, seeing the interval thus left by Wood, was closing in to his left when he was struck; Sheridan, who was in the act of starting to join Thomas, had barely time to reform line before he too was struck. In addition to the gap which Davis was in the act of closing up on his left, there was an interval of several hundred yards between him and Sheridan; on the right of Sheridan was nothing, therefore he and Davis were both detached,—outposts, as it were.

Davis' Division, consisting of only two brigades present, happened to be behind a slight breastwork constructed by some other command, in a strip of woods in front of which were some small fields surrounding the Brotherton house, situated on the State Road. Behind this strip of woods were open fields, interspersed with patches and strips of wood, covering the hills on each side of a by-road leading back from the Brotherton house to the road leading to Chattanooga by the McFarland Gap.

This was the road taken by Davis' command after it became broken.

The two brigades of Davis' Division met the enemy with such a deadly fire as to stun him for a moment, and cause some confusion in his ranks. Recovering from this, General Johnson, commanding the leading division of Hood's column, says: " my whole line, Gregg's brigade in rear, supported by Hood's Division under Law in a third line, swept forward with great force and rapidity, and carried the breastworks, from which the foe precipitately retreated under a heavy fire, particularly directed to the left from my left brigade." A few hundred yards brought Davis' disorganized men into the open fields in rear of the woods from which they had been driven. Here they were exposed to the full effect of the fire of the pursuing enemy. Ineffectual attempts were made by brigade and regimental commanders to reform their lines on a rocky ridge in the open field a few hundred yards to the rear, but the heavy loss of officers made the attempt only partly successful. It was however sufficient to check, for a moment, the advance of the enemy; but Johnson, straightening up his line, again rapidly advanced, driving everything before him. It was at this time that Hood received the wound which caused him the loss of a leg. The command of the column then devolved on Kershaw, the next officer in rank.

Owing to the movements of Davis' brigades his two batteries were unable to get into position with their brigades before Hood struck the blow; they were then ordered at once to the rear, and neither of them fired over half a dozen shots during the day.

Davis' brigades, failing to rally, fell back to the Dry Valley Road, which they followed to the more open ground beyond McFarland's Gap, where the men were gathered together and dispositions made to resist the enemy should he follow. Here the batteries rejoined their brigades. They had become inextricably involved among the trains of wagons, ambulances and artillery carriages crowding and hurrying along that narrow and tortuous defile.

It will be remembered that Sheridan had formed two of his brigades into columns to march as a reinforcement to Thomas. His remaining brigade—that of Laiboldt—was favorably posted on a hill to the rear and right of Davis, for the support of the latter. From this hill it made a bold advance to check the enemy, now breaking Davis' line. In this advance the brigade was

accompanied by its battery,—"G," First Missouri,—which endeavored to come into battery under a heavy fire of musketry from the enemy; but before it could do any firing, or extricate itself, its captain, Hescock, and three of the pieces fell into the hands of the enemy.

Sheridan's other two brigades were moved along the ridge to the support of Laiboldt, and advanced down the hill with it. Lytle, commanding one of the brigades, posted his battery—Sutermeister's 11th Indiana—near the base of the hill. Here it was enabled to get in a few rounds of canister before being obliged to withdraw, but owing to the loss of horses the captain was obliged to abandon two of his pieces. The other four escaped and coming into battery on the hill in rear did some firing before being finally driven from the field. General Lytle was killed at this time.

Bradley's Brigade and its battery had the same experience as the other two. The battery did some valuable firing, but, owing to the loss of horses, had to abandon three of its pieces. All of these brigades held their ground as long as it was possible to do so, but they had to fight in an isolated position against the whole of Hindman's Division; as well as part of Hood's column.

The whole of Sheridan's Division fell back in disorder to the Dry Valley Road, but here the brigades were rallied, and conducted by Sheridan over Missionary Ridge and past McFarland's Gap to the Rossville Gap, where, taking the State Road, he came in on the extreme left to the assistance of Thomas. The latter however had commenced to withdraw before his arrival, and he had no opportunity of entering the fight on that part of the field.

The divisions of Sheridan and Davis did some gallant and stubborn fighting before giving way. Longstreet bears gruesome testimony to this in his report, saying:—"The enemy's dead at this point marked well his line of battle."

This flank of Rosecrans' army, as well as the one from which Breckinridge was repulsed, was entirely in the air; but Longstreet, confident in his numbers, resorted to no turning movement. He simply aimed to pulverize it by one blow. Sheridan and Davis had, between them, 30 guns. Had these been massed on one or two of the eminences on that flank they undoubtedly would have held the enemy in check and afforded the infantry opportunity for rallying. As it was the batteries stuck close to their brigades and were enabled to do but little service; in fact no service at all.

During the night after the battle of the first day, Crittenden was ordered to hold Wood's and Van Cleve's divisions of his corps in reserve to assist either wing of the army in case of need. For this purpose he selected a hill five or six hundred yards in rear of the main line, and directly in rear of the opening subsequently left by the withdrawal of Wood. In front of this hill were open fields, in one of which stood the Dyer house. As a matter of convenience the hill has been called by the same name.

The batteries of the two divisions, some six in number, were posted on the hill, and the divisions massed near by. But soon after daylight on the 20th Wood was sent to replace Negley on the front line, and two brigades of Van Cleve's Division were hurried to the left to assist Thomas. One or two of the batteries were left on the hill, and about the time of Longstreet's attack were joined by others until there were in all 26 guns. The withdrawal of the infantry had left them entirely without support, and when struck by the enemy they were speedily dispersed. It was expected by Captain Mendenhall, Crittenden's chief of artillery, when sending the batteries there, that the infantry now breaking on the front line, would rally on these batteries and form a new line. In this he was, however, disappointed. The divisions of Sheridan and Davis belonged to another corps, were some considerable distance off to the right, and knowing nothing of this line of guns, or of the lay of the land on that part of the field, fell back by the Dry Valley Road, thus passing around the right of the position occupied by the batteries. The other troops that were broken, or at least most of them, were rallied on a new line connecting the intact part of the original line with Snodgrass Hill, which was several hundred yards to the left, or north, of Dyer's Hill.

It will be remembered that when Wood withdrew to "close up on Reynolds," he passed by a flank movement in rear of Brannan's Division, which continued to hold its place in line. When Hood struck his blow Wood's Division was directly behind that of Brannan, and close behind him was Samuel Beatty's Brigade of Van Cleve's Division, then upon the point of starting for Thomas' left. These three commands,—Brannan's, Wood's and Beatty's—formed the right jamb of the opening through which Hood thrust his column. But the opening was not wide enough and Hood's right brigades struck each of these commands and thrust them aside. Brannan's right brigade, that of Connell, was badly broken

up; a portion of it, under its commander, joined the troops Negley was then collecting on Snodgrass Hill, and which were so ingloriously led from the field; the other portion rallied with other troops under Brannan and did brave service in the fighting yet to come. The battery with this brigade, Church's Michigan, managed to get in a few shots, but lost three of its pieces; the other three, escaping, joined the batteries on Dyer's Hill, where two of these also were captured.

The falling away of Connell's Brigade exposed the flank of the next brigade on its left, which was Croxton's, and which, while endeavoring to change front to fire to the right, became broken in two, one half joining, or rather remaining in contact with Reynolds' Division, still intact on its left, while the other half was rallied on Snodgrass Hill and gallantly assisted in the desperate fighting that took place there. The battery with this brigade—Lieutenant Gary's Ohio,—after firing a few shots, extricated itself from the melée with the loss of one gun, and joining Negley was marched from the field.

Brannan rallied such men as he could of his own division on Snodgrass Hill and, perceiving the vital importance of the position, prepared to hold it to the last extremity. Negley had by this time succeeded in collecting together eight batteries and parts of batteries, numbering altogether 52 guns, together with quite a large infantry force, all of which he organized into a marching column, and then quietly conducted the whole from the field, and joined the mass of fugitives hurrying along the Dry Valley Road to McFarland's Gap. Fortunately Smith's regular battery remained, and this Brannan supported with the handful of troops he succeeded in rallying. The latter were subsequently joined by fragments from Wood's and Van Cleve's divisions, together with some from Negley's Division arriving too late to be marched away by him. He was also strengthened by several regiments loaned him by Palmer and Reynolds. Altogether he had about 2500 men with which he bravely held the hill until the timely arrival of Steedman's Division of Granger's Corps and Van Derveer's Brigade late in the afternoon.

It will be borne in mind that Wood's Division was directly in rear of Brannan's when the enemy struck his blow. His right brigade, that of Buell, was carried away bodily. Buell succeeded in rallying one or two regiments which he placed on Brannan's right, on Snodgrass Hill, where they did splendid service. The

other regiments, scattered and broken, found their way back to the Dry Valley Road and thence to McFarland's Gap. The battery of this brigade, Estep's Indiana, was on Dyer's hill and fell bodily into the hands of the enemy.

Wood's other brigade, that of Harker, changed front to meet the enemy on its flank, and bravely stood its ground. Samuel Beatty's Brigade, which, it will be remembered, was directly behind Wood, was overrun by the troops breaking in front of it, and was thrown into utter confusion. It was however rallied in separate portions, and joining Brannan on Snodgrass Hill bravely assisted in holding that vital position. Swallow's Indiana battery, belonging to this brigade, was in position on Dyer's Hill, from which it fired a few shots before being driven away by the enemy. It lost one piece.

Snodgrass Hill, so frequently mentioned, was a prominent spur of Missionary Ridge, extending down from the latter in an oblique direction in rear of the right of Thomas' wing. On the opposite side of the hill from Thomas' position is the Dry Valley, along which a road runs to McFarland's Gap. The ground to the southward of the Snodgrass spur is very much broken by hills and ridges, one of which is the Dyer Hill or ridge, upon which the batteries so often mentioned were stationed. On the opposite side of Dry Valley, which is a mere cañada, are other spurs of Missionary Ridge, along the slopes of which Hindman's Division, the extreme left of Bragg's army, followed the broken troops of Rosecrans' right wing, and then crossing over, joined in the attack on Snodgrass Hill. The crest of this hill has a crescent shape, with the concavity towards the southward or Dry Valley side, forming somewhat of a cove, sometimes called the "Horse-shoe." This particular point became the scene of the most bloody strife. Around the rim of this cove or "Horse-shoe" Brannan posted the troops he had rallied. A short distance to his right were the troops, including 52 guns, which Negley had collected. Smith's battery of the 4th U. S. Artillery, belonging to Van Derveer's Brigade, then on the extreme left, was included among these guns. This battery was next to Brannan's position, and was left behind when Negley moved away; it then attached itself to Brannan's command.

On the left of Brannan's position were the troops rallied by Wood. These extended down the slope and across a narrow valley at the foot of the Snodgrass spur. The line thus formed was

perpendicular to the one held previous to Longstreet's assault. Its left connected with Reynolds' Division, which had not been moved from its position, and was still a part of Thomas' compact line. Between Reynolds and Wood was an interval, or thin part of the line; later in the day this was filled, or strengthened, by Hazen's Brigade, brought over from Palmer's position, which was on the left of Reynolds. The line thus formed was continuous and reasonably compact from Brannan on Snodgrass Hill, around to the left of Baird on the State Road, where Breckinridge and Forrest had made their attacks earlier in the day. It was an irregular semicircle with a diameter of about half a mile.

On this line Thomas had all that remained intact of Rosecrans' original line of battle, from which had been swept away the divisions of Davis and Sheridan, and part of Van Cleve's Division; Negley took away about 3500 men, and in addition there was a miscellaneous lot of stragglers, from Wood's, Brannan's and other divisions, estimated at about 1500. Roughly stated, Thomas had about two-thirds of Rosecrans' infantry force. In artillery he was not so fortunate. Five batteries had been swept from the field with the divisions of Sheridan and Davis, and five more from Dyer's Hill. Negley took away seven batteries and parts of other batteries, leaving for Thomas only ten, and most of these had suffered more or less in the fight of the day before; so that he had in reality but 51 pieces. Thomas was the sole commander,—Rosecrans, McCook and Crittenden had all been carried to the rear in the break on the right. On his way to Chattanooga, Rosecrans dispatched Garfield, his chief of staff, to Thomas, informing him of what had happened to the right wing; and, directing him to assume command of everything remaining on the field, left it to his judgment when and how to retire to Rossville, there to take up a fresh position for resisting the further advance of the enemy. Rosecrans proceeded on to Chattanooga to make arrangements for the disposition of his army when it should fall back to that place. Garfield reached Thomas about 4 P. M. On his way through Rossville Gap he found that Granger had gone with Steedman's Division to the assistance of Thomas.

At this time, although there was no fighting going on on the left, the battle was raging furiously from the centre around to the right. Thomas' only hope therefore was, by resolute fighting, to hold his ground until night should afford him more favorable opportunity of withdrawing. Until the arrival of Granger on the

right of Brannan, Smith's battery was the only one on the new line of Snodgrass Hill. On the other, or old part of his line, the batteries remained as before, distributed with their brigades along the line of temporary breastworks.

The position now held by Thomas was the strongest yet occupied by Rosecrans' army, and the resistance that he was capable of making to the most desperate efforts of the enemy, indicates plainly the ground which Rosecrans should have taken up in the first place for a defensive battle; here his right would have rested on Snodgrass Hill and his left on Missionary Ridge at Rossville Gap. The chances of success would then have been decidedly in his favor and the result would doubtless have settled all question as to which side won the battle.

Returning now to Hood's column of assault; Bushrod Johnson, commanding the leading division, straightened up his line which had become somewhat disarranged by the first shocks, and then started forward again. He says:—"Our lines now emerged from the forest into open ground on the border of long, open fields, over which the enemy were retreating under cover of several batteries, which were arrayed along the crest of a ridge (Dyer's Hill) on our right and front running up to the corner of a stubble field, and of one battery (one of Sheridan's) on our left and front posted on an elevation in the edge of the woods, just at the corner of a field near a peach orchard, and southwest of Dyer's house."

As previously mentioned, the batteries on Dyer's Hill had been left entirely without infantry support. Crittenden, Van Cleve and other officers made unsuccessful attempts to rally fugitives to their support. As soon as the fronts of the batteries were clear of the fugitives some of them opened fire and for a brief period retarded the advance of the enemy; but the latter, throwing out a cloud of skirmishers, gradually worked around through the ravines and brush, and gained positions on their flanks, and partly in rear. What now occurred is best told in the language of Captain Estep, one of the battery commanders, who says:—"I immediately cautioned my lieutenants about holding fire till ordered (until our own men got out of the woods in front), but a few moments elapsed, however, till the enemy came up in splendid style in heavy lines to the right of my front. I ordered firing to commence with shell and canister. I am confident that we killed and wounded hundreds of them as they came up. Other

batteries were in the same line with mine and dealing perhaps equal destruction to the enemy, but just then when I supposed that we were going to drive them back, we received a galling fire from the enemy who had got position in force on our right flank and rear; but a moment more and the enemy was charging us from the right. My horses were killed and disabled and I could do nothing but leave the battery in his possession." The other batteries had a similar experience; they were all crippled by the loss of horses, and out of twenty-six guns fifteen fell into the hands of the enemy. In withdrawing what they could save under such heavy pressure, the batteries had no other direction to follow except to the Dry Valley, where they took the road to McFarland's Gap, near which place they eventually joined their respective brigades.

Notwithstanding this loss of so much of the artillery force from the field, the time gained was of the utmost importance. It enabled Thomas' troops to get into position on Snodgrass Hill, now the key-point. It also enabled the divisions of Sheridan and Davis to pass by on the Dry Valley Road before being intercepted by Hood's column. It will be remembered that these divisions did not break and scatter to the rear when first struck by the enemy, but rallied and turned at several points, thus consuming the time which would have enabled Hood's troops to reach the road in advance of their passage had it not been for this delay.

It was now about mid-day. Johnson, after capturing the guns on Dyer's Hill, pressed forward his line through a narrow strip of woods and across open fields to another ridge about 600 yards from Dyer's Hill. From the crest of this ridge the ground descends abruptly to Dry Valley, in which, at the upper extremity of Snodgrass Hill, is a small cove in which stands Villeto's house and fields. The road along this narrow valley was a confused mass of wagons, ambulances, guns and caissons; quite a number of which were captured by the enemy near the Villeto place. Some of the wagons were loaded with infantry ammunition, which gave a timely supply to the enemy, while Thomas' troops, defending Snodgrass Hill, became so exhausted of it that the boxes of the dead and wounded were searched for a last round.

After gaining possession of the last ridge referred to, Johnson halted for short time to reform his line and reëstablish connection with other commands, from which he had now become quite separated, being considerably in advance of them. The division

commanded by Law, following immediately after Johnson, had scarcely passed beyond the line which had recently been occupied by the Federal troops when it received such a fire upon its right flank as to cause it to stampede, under the impression that it was being flanked by Thomas' troops. Law's three brigades were not again brought into the battle.

Kershaw's Division, composed of his own and Humphreys' brigades and forming the third line of Hood's column, changed front to the right and moved along the valley that lies between the foot of Snodgrass Hill and the State Road. This movement, if successful, would have taken the main part of Thomas' line in reverse. From the extremity of Snodgrass Hill there extends to near the State Road a narrow ridge, the abruptness of whose sides gives to it the quality almost of a natural parapet. Troops holding it could load behind it out of reach of the enemy's fire and then advance to the crest of it to deliver a plunging fire on the advancing foe. These were still the days of the muzzle loader, requiring considerable time for the soldier to charge his piece. The troops holding the ridge had, in addition, the moral effect inspired by the command which it had over those below. Wood, perceiving the advantage of this ridge, placed Harker's Brigade and a part of Buell's behind the crest. Later in the day Hazen's Brigade took position alongside of Harker. Neither of these had with them their batteries; that of Harker had fallen into the hands of Negley, and that of Hazen had been left in position on the line from whence the brigade had moved. Thomas had no reserve with which to strengthen a weak point, and had but a single line, a break at any point of which meant a break of the whole.

While Kershaw was swinging around his division, in the manner stated, Bushrod Johnson changed his front also to the right so as to attack Snodgrass Hill, and Hindman, crossing over Dry Valley, brought his division up on the left of Johnson. Johnson had four batteries, two of which stuck close to his division throughout the day and were exceedingly active in taking positions from which they gave great annoyance to the Federal troops. These batteries were now brought up to dislodge Smith; but the latter held his ground, and with his lieutenant,—Rodney,—fought his guns until dark put an end to the conflict, when, with the rest of the troops, he withdrew, having but six rounds remaining in his chests.

About 2 P. M. Johnson, with his own three brigades and one of Hindman's, made an impetuous charge against the hill, but was signally repulsed, and forced back to the ground from whence he had started, where he reformed his command and waited for the arrival of Hindman's other two brigades. The ground in front of Snodgrass Hill over which the enemy had to manœuvre to make these attacks, was greatly broken into hills and ravines, thickly covered with woods and underbrush. The crests of the hills or ridges were each a little higher as Snodgrass Hill was approached, which latter had an elevation of about 200 feet above the general level of the ground at the base of the hills or ridges. Snodgrass Hill was wooded, but beyond it were fields in which stood the Snodgrass house, now used as a field hospital. Towards its upper extremity the hill was cut through by a ravine which the enemy took advantage of to get in rear of Brannan's right. The Federal troops holding the hill were without even the semblance of rifle pits or breastworks.

Johnson being now joined on his left by Hindman's two absent brigades, and all in readiness, with his batteries so disposed as to assist in the assault or take advantage of any success, the whole line moved forward over the broken hills and gulches to the second assault upon this part of Snodgrass Hill. Hindman's brigades extended beyond that part of the hill held by Brannan, and were rapidly gaining his rear through the cut, or ravine, just referred to.

At this most critical moment of the battle Granger made his appearance with Steedman's Division of two brigades and two batteries. Granger, guarding the approaches to Rossville Gap, had heard the sound of the battle four miles off to his right, and judging from the way it had been moving that something was wrong, with true soldierly instinct deemed it his duty to go to the assistance of his comrades, although without orders to do so. On his way he had met some of Forrest's dismounted cavalry and some of Breckinridge's troops, who attempted to intercept him or cause delay. Detaching Col. Dan McCook's Brigade to attend to these he hastened on with Steedman's two brigades.

Following close upon Granger was Van Derveer with his brigade, which it will be remembered had been sent in the forenoon to assist in repulsing Breckinridge from the extreme left. Smith's battery, belonging to this brigade, was already and had been for hours on the ground doing distinguished service. Gran-

ger came up directly in front of the gap through which the enemy was making his way, and occupied the ground lately vacated by Negley. Van Derveer took position on his left and on the right of Brannan.

Granger did not wait for the enemy but advanced to meet him, and here took place one of the most obstinate struggles of the day, resulting in the repulse of the enemy, who was pursued and driven back behind the ridge from whence he came. So badly was the enemy broken up that Hindman's three brigades, says Johnson, "did not again enter the fight. * * * The retreat on this hill was precipitate, and called for all the exertions I could command to prevent many of the troops from abandoning it. The officers, however, joined with every energy and zeal in the effort to stay the retreat, and by appeals, commands, and physical efforts, all save a few who persisted in skulking behind trees or lying idly on the ground, were brought up to our lines in support of the artillery." These were among the choice troops of the Confederacy, and their demoralization but shows the spirit of the attack by which they were repulsed. The slaughter that took place in this assault and repulse was, upon both sides, unprecedented.

With such troops as Johnson could bring to the scratch he made several attacks, each feebler than the foregoing, until near sundown, when another general advance was made.

Almost of as much importance as the troops themselves was the ammunition brought by Granger's brigades. Thomas was cut off from his ammunition trains, and Brannan's troops had expended their last rounds and were searching the boxes of dead comrades for a few more cartridges, when Granger appeared with a fresh supply.

The two batteries accompanying the brigades of Steedman's Division did their full share of the work of repulsing the enemy. These were the 18th Ohio battery under Captain Aleshire, and battery "M," 1st Illinois, under Lieutenant Burton.

Kershaw's Division followed that of Johnson until it arrived where the Federal line had been before being swept away by Johnson. Here it changed front to the right, which occupied considerable time, and then commenced to move northward parallel to the State Road, which brought his brigades fronting the position held by Wood with Harker's Brigade and a few regiments from other brigades. After a little preliminary skirmish-

ing, Wood fell back to the narrow ridge terminating the lower extremity of Snodgrass Hill, and which has already been mentioned as a natural parapet across the narrow valley between the base of the hill and the State Road. The left of Kershaw's Division covered also a portion of Snodgrass Hill. From this point the line was continued to the left by the divisions of Johnson and Hindman.

About 1 P. M. Kershaw made his first attack with his own and Humphreys' brigades. This was handsomely repulsed "after," as Kershaw says, "one of the most gallant struggles I have ever witnessed." About 3 P. M., being reinforced by Anderson's Brigade of Hindman's Division, he made another assault in conjunction with the troops on his left. This attack likewise was repulsed. Longstreet now ordered forward Preston's Division, the one held in reserve, for a final effort; this was made about 4 o'clock, but with no better result than the former. It was the one which Granger and Van Derveer took part in repulsing. The most experienced soldiers declared it to be the severest battle of musketry they had ever witnessed. Until Granger arrived with the two batteries of Steedman's Division, Smith's was the only battery on that line, but it was heroic, and the enemy are free in stating the damage it caused them.

This virtually closed the contest on the right flank of Thomas' position. Longstreet applied to Bragg for assistance from Polk's wing, "but was informed," says Longstreet, "that his troops had been beaten back so badly that they could be of no service to me."

Stewart's Division, a part of Longstreet's command, flanking Hood's column of assault on the right, moved forward with the column, but striking Reynolds' two brigades behind their breastworks of logs was so badly repulsed that it had to retire to its first position to reform. Stewart, who was a veteran of experience, describing his assault, says: "For several hundred yards both lines pressed on under the most terrible fire it has ever been my fortune to witness, * * * new batteries being opened by the enemy on our front and flank, heavily supported by infantry, it became necessary to retire. * * * During this charge, which was truly heroic, our loss was severe."

Thomas had now repulsed every corps, division, and brigade of infantry in Bragg's army, as well as some of his dismounted cavalry. All of these had been brought up twice to the assault,

most of them three, and some of them four times, until there was no more assault left in them for that day. For anything that the enemy was capable of doing to the contrary, he could apparently have held his position indefinitely, had it not been for lack of ammunition. His trains had been cut off from him and were beyond Missionary Ridge. He however managed to get up a small supply with which to insure his safe withdrawal. His troops were suffering also for food and water. Under these circumstances he determined to hold on until nightfall, and then withdrawing, fall back to Rossville Gap, and there take up a position to hold the enemy in check until the scattered troops of the right wing could be collected for a new defensive line at Chattanooga.

The movement was commenced by Reynolds' Division at 6 o'clock, which on that day of the year was the hour of sunset. Reynolds was to post his division so as to cover the withdrawal of the other troops, but soon after leaving his line a body of the enemy was seen approaching the left flank behind Baird. This proved to be a part of Breckinridge's Division, again feeling its way around that flank. A sudden dash of one of Reynolds' brigades drove these back, after which Reynolds' brigades, together with that of Willich, took commanding positions to cover the withdrawal of the other troops. Baird, Johnson and Palmer followed; but the enemy, having gathered himself together for a final effort, now advanced and attacked with fury these divisions as they were in the act of leaving their breastworks. This resulted in some confusion and considerable loss in killed and wounded and a few prisoners, but after regaining the shelter of the woods beyond the Kelley fields the brigades were reformed and taking the "Ridge Road" reached Rossville without being pursued. Wood and Steedman retired from Snodgrass Hill without molestation. By some oversight Brannan had not been notified that his right was uncovered. The enemy, on the alert, perceiving this, pushed through the ravine on the right of where Steedman had been and was forming in rear of Wood's position, when Van Derveer and some other of Wood's troops turned upon them, and after a brief but severe conflict drove them back, thus securing the safe withdrawal of the whole.

The enemy made great capital out of these last attacks, claiming that they had driven Thomas from his position. Immediately after the withdrawal of the latter the enemy occupied his lines, but advanced no further. Thomas brought with him

from the field all of his artillery, save two pieces with broken carriages; all ambulances and wagons, leaving nothing for the enemy but the unfortunates too badly wounded to be removed, and these were gathered into field hospitals and left with medical supplies and attending surgeons.

Frequent mention has been made of General Negley's strange conduct on this day; and, as his withdrawal from the field occasioned the loss to Thomas of 48 pieces of artillery, leaving him but 51 with which to maintain his position, it is pertinent to be more explicit on this point.

It has already been stated that, to strengthen his left flank against the dangers then threatening it, Thomas instructed Negley "to mass as much artillery on the slopes of Missionary Ridge, west of the State Road, as he could conveniently spare from his lines, supported strongly by infantry so as to sweep the ground to the left and rear of Baird's position." Under these instructions Negley soon collected batteries and parts of batteries to the number of 52 pieces; but, misapprehending the purport of Thomas' order, instead of posting them so as to protect the left flank, he sent them to Snodgrass Hill in a direction directly opposite from that intended. Here supporting them with one of his brigades intact and such parts of other brigades as he could pick up, he placed some of the batteries in positions from which they did some long range firing upon Longstreet's force, which by this time was driving the right wing up the Dry Valley Road. His position on the hill or ridge was to the right of Brannan, and about the place where Steedman afterwards met the enemy.

At this time the fighting was very heavy on the left at the point where Negley should have posted his batteries, and in fact also it was heavy all around to Brannan's position. Stragglers were numerous from both the right and left. These seem to have given Negley the impression that the day was lost, and being overwhelmed by the responsibility of so much artillery on his hands, he formed it into column with the infantry he had collected and, marching by a wood road to his right and rear, reached the Dry Valley Road which he followed through McFarland's Gap. Here he halted and with his organized regiments was energetic in collecting stragglers and organizing them so as to resist the enemy should he reach the gap. He left Snodgrass Hill but a short time before Hindman's and Johnson's divisions made the furious assault before mentioned. Had he remained a few minutes

longer he could not have withdrawn by that route, and would have been compelled to fight. His whole idea seems to have been to save his artillery—not to use it. In the meanwhile the infantry brigades on the left, that he should have been attending to and which were battling to keep the enemy from crushing that flank, were allowed to take care of themselves.

The infantry conducted away has been variously estimated from 700 up to 3500. Negley claims the first figure, but the latter more nearly represents the number who left the field consequent upon his action. He withdrew without orders, and without being driven off, and while his comrades were hotly engaged holding, by the skin of their teeth, the ground upon which they fought, and who were in dire need of the guns and men he was taking from them. A Court of Inquiry, after a rather perfunctory examination of the case, accepting his views, namely, that it was his first duty to save his artillery—not to use it, exonerated him from all blame.

In the open ground beyond McFarland's Gap, he collected stragglers which he organized, and with the troops he already had made a force of about 5000 men. Davis soon arrived with the remnants of his division and in a short time thereafter Sheridan, with his division well in hand. It was then learned that Thomas was still holding his ground, and a consultation was held; when it was determined that Davis should remain to guard McFarland's Gap, while Sheridan should proceed on to hold Rossville Gap. Negley was to take position between the two to give assistance to either. The batteries had now joined their brigades from which they had become separated. Arriving at Rossville Gap, Sheridan found that Granger had gone to the assistance of Thomas, whither he, too, at once proceeded.

This was the state of affairs when Thomas fell back from the position he had so skillfully and bravely defended. By midnight he had established a line along Missionary Ridge covering both gaps, and with strong reserves in rear, using for this purpose all troops within reach. The troops were in good condition, except from the great fatigue of two days' hard fighting. Only a few had straggled back to Chattanooga, or beyond recall. Thomas, in the absence of Rosecrans, commanded the whole, and held the position until after nightfall of the following day when he withdrew, each corps, division and brigade going direct to the position assigned it on the new line near the town.

During the 21st, Bragg made threatening demonstrations on Thomas' line and there was some sharp skirmishing, but the former deemed it prudent not to make any general attack.

Rosecrans lost in the battle of both days 1657 killed and 9756 wounded; total 11,413. He lost also 4757 missing, most of whom were either killed or wounded, but not being otherwise accounted for, were reported as missing; making a grand total of 16,170.

Bragg's losses, as compiled from the "Records of the Rebellion," aggregated 17,804, or 1634 more than his opponent. He probably did not have quite so many captured as his adversary. Rosecrans reports that he captured from him 2005. The loss in the two armies was about in proportion to their relative strengths. In killed and wounded, not counting the missing, it was about eighteen per cent. In some of the Federal subdivisions it reached the terrible figure of fifty per cent. In Steedman's Division the loss was 1178 out of 3700.

The intensity of the fighting in this battle will be better comprehended when it is observed that in the Franco-Prussian war in 1870 the average loss at the battles of Woerth, Spicheren, Mars-la-Tour, Gravelotte and Sedan was twelve per cent. At Magenta and Solferino, in 1859, the average loss of both armies was less than nine per cent. At the great battles of Marengo and Austerlitz, sanguinary as they were, Napoleon lost an average of less than 14.5 per cent. The loss of Wellington at Waterloo was less than twelve per cent.

Rosecrans represented the number of guns lost as 36. Bragg claimed 51; but this included 15 captured from his troops and left on the field for want of horses to draw them off.

As Bragg's army slept on the field, it was claimed that he had won the battle, and great was the rejoicing over it throughout the South, and among their sympathizers in the North. For a time appearances certainly favored this view; the enemy, following up Rosecrans, closely besieged his army in Chattanooga, and cutting his lines of communication, reduced it to starvation. A large number of artillery horses perished for want of forage, and the remainder became so reduced in strength as to be unserviceable. This state of things continued about a month, until the arrival of Sherman with the Army of the Tennessee, when communication was reopened.

But, however it may have been with the battle, whether a tactical defeat or victory, it is certain that Rosecrans had gained

the objective of the campaign, which was the capture of Chattanooga, the strategic centre of the middle zone of the Confederacy, and the gateway to its vitals. Bragg had been manœuvred out of it by Rosecrans' masterly strategy, and being heavily reinforced, attempted to regain it by crushing the Federal army. In this he failed, and hence the victory rested with his adversary. Chattanooga was never regained by the enemy, but became, a few months afterwards, the base from which Sherman started on his memorable march to cut the Confederacy in twain.

That Bragg with his superior numbers, and the tactical advantages given him by Rosecrans, did not crush the Federal army, was due to the inferior generalship of Polk, opposed to the sturdy repellant blows of Thomas.

In this battle the Federal artillery had to contend with every disadvantage possible, except one, which was that the individual batteries were good and well commanded; but the wooded character of the country, taken in connection with the restriction imposed upon them by being tied down to diminutive brigades, neutralized this, a fact clearly and forcibly expressed by Colonel Harker, one of the brigade commanders, who in his report says: "I have already stated that I had directed Captain Bradley [*commanding the battery attached to his brigade*] to keep well to the rear, but to conform his movements to my own. I did this partly from prudential considerations and partly from what I conceived a proper appreciation of the artillery arm of the service. While I have no disposition to criticise the conduct of others, and particularly my superiors, I nevertheless consider it my duty to state that I believe in many instances batteries in the late engagement were placed in positions where artillery could not be effectively used, and, from the nature of the country, could not easily be extricated. I believe that it was in this way that most of our artillery was lost in the late engagement. In other instances, from a want of judgment and knowledge of our lines, some of our artillery injured many of our own men. I submit this question as one of such great importance in the science of battles as to merit the serious consideration of the general commanding the department."

And it did receive such consideration. The events of this battle, to say nothing of that of Stone's River, opened the eyes of Rosecrans to the glaring defects of the organization and command of his artillery, and it was not many days before he adopted

remedial measures. The batteries were taken from infantry brigades; two were allowed to each division, while the other seven of each corps were organized into a brigade (battalion) and placed under the direct command of a field officer of artillery, and the whole artillery of the army under Brigadier-General Brannan, who had so ably commanded an infantry division in the preceding campaigns, and was furthermore an experienced artillery officer. From this on there was an efficient service of artillery in the Army of the Cumberland, and while the effective work done by it was increased there was no further loss of guns by the score.

At the same time that the artillery was reorganized the infantry received a better organization. The two corps that had been commanded by McCook and Crittenden were consolidated into one, which received the designation of the Fourth, in place of the old Fourth, of the Army of the Potomac, which had become extinct. This was placed under Gordon Granger.

Shortly after the battle of Chickamauga the Eleventh and Twelfth Corps were hastened from the Army of the Potomac to assist in opening the blockade of Chattanooga. These were soon after merged into one,—the Twentieth,—under Hooker, and from this on constituted a part of the Army of the Cumberland. In this reorganization of the infantry, the numerical strength of brigades was greatly increased, giving heavier divisions with increased efficiency.

About the last of October Rosecrans was superseded in command of the Army of the Cumberland by Thomas. Grant was assigned to the command of the whole Military Division of the Mississippi, which was made to embrace the Army of the Cumberland under Thomas, of the Tennessee under Sherman, and of the Ohio under Schofield, together with other troops not immediately connected with the military operations from Chattanooga to Atlanta.

Rosecrans had been in command of the Army of the Cumberland just one year, during which time he had fought the battles of Stone's River and Chickamauga, and had thrust the enemy back from Nashville to beyond Chattanooga, thus recovering all the ground that had been lost by Halleck's disposition of troops while in command, in the field, during a few weeks after the battle of Shiloh.

A short time after the arrival of Sherman with the Army of

the Tennessee to the relief of the beleaguered Army of the Cumberland at Chattanooga, that is, on the 23d to the 25th of November, was fought the battle of Missionary Ridge, which forced Bragg back to Dalton, about twenty-five miles further south, where his army rested during the winter. Meanwhile, Grant was created lieutenant-general and placed in command of all the Federal armies, and making his headquarters with the Army of the Potomac, turned over his western command to Sherman, who, during the winter, prepared the Armies of the Cumberland, Tennessee and Ohio for the Atlanta Campaign of the following spring. Brigadier-General Barry was assigned to him as chief of artillery, and with characteristic energy soon brought about many improvements, chief among which may be mentioned the simplification of the calibres of pieces, which up to this time had been greatly mixed in the batteries of the western armies, thereby causing great difficulty and confusion in the supply of ammunition and stores. From twelve, the number of calibres was reduced to four. The proportion of guns was likewise reduced from three to two per 1000 men. The surplus guns were sent to the rear to serve as guns of position at the various fortified places necessary to maintain so long a line of communication through a hostile country. The entire artillery force that took the field with the three armies just mentioned consisted of 50 batteries of 254 guns, 167 officers and 6125 men ; for the command of all of which there were besides Barry, as chief of artillery of the whole, one brigadier-general, one colonel and one lieutenant-colonel,—chiefs of artillery of each army respectively,—and the ridiculously small number of five majors for the command of brigades and battalions of batteries. Captains had to be detached from their batteries to perform the duties of field officers. It has frequently been mentioned in this series of papers that it was the policy of the Government to have as few field officers of artillery as possible. Starting out blindly with this policy, it was adhered to even after its folly had been fully demonstrated, and army commanders were making exertions to get more.

For Sherman's three combined armies an Artillery Reserve of 18 additional batteries was organized, but, owing to the nature of the campaign, this reserve did not follow the movements of the active force, but was left at Nashville where it acted as a feeder to supply the batteries at the front, thus keeping the latter always in the highest state of efficiency.

No regularly equipped horse batteries, such as those of the Army of the Potomac, served with the Western armies; but suitable mounted batteries, equipped as lightly as possible, were selected for service with the cavalry and did efficient service.

On the 6th of May, 1864, Sherman having concentrated his army in the vicinity of Chattanooga, commenced his Atlanta campaign. His active army then consisted of 98,797 men of all arms, and 254 guns; opposed to which was the Confederate army intrenched at Dalton, consisting of 60,000 men in round numbers, with a proportional amount of field artillery. In his fortifications at Atlanta the enemy had 20 pieces of heavy artillery. This army was now commanded by "Joe" Johnston, who had superseded Bragg; but before the capture of Atlanta Johnston himself was superseded by Hood, who continued in command until his army was broken and scattered by Thomas on the 15th of the following December at the battle of Nashville and the pursuit that followed.

As Sherman advanced, Johnston was forced to fall back from one point to another, intrenching at every eligible position, and making desperate resistance everywhere.

In this way occurred a series of hard fought battles in which the artillery was conspicuously efficient. On July 20th the Federal army closed in upon Atlanta, which was strongly fortified and well armed. From this time to September 1st was a series of desperate battles, in all of which the artillery took a most prominent part.

On the night of the date last mentioned the enemy evacuated this stronghold, which virtually terminated that part of these operations known as the Atlanta campaign. But there were other operations yet to follow.

About this time the Confederate States President, Davis, visited Hood's army and projected for it a campaign in which, by a circuitous march of some three hundred miles, it was again to invade Tennessee, and thus cause Sherman to withdraw. The movement for the execution of this project was commenced by Hood during the last week of September. To meet it Sherman detached Thomas with the Fourth Corps under Stanley, and the Twenty-third under Schofield, with instructions to gather up the various detachments guarding the lines of communication back to Nashville, and all other troops he could lay his hands on, and drive Hood back. This resulted, as before stated, in the utter destruction of Hood's army as an organized force.

Besides the large numbers that were killed and wounded Thomas captured upwards of 13,000 prisoners, including eight general officers. A large proportion of those still remaining turned off at every cross-road and by-path to their homes; a few, and but very few, were held together to join other armies. Thomas captured 72 pieces of artillery and nearly all of Hood's remaining ammunition.

Thus passed out of existence the most formidable rebel army of the West; the one to which the Army of the Cumberland had been constantly opposed. It was originally part of the force with which General Albert Sydney Johnston assailed Grant at Shiloh on April 6, 1862; the object of which battle was, by defeating Grant, to open the way for an invasion to the Ohio River through Tennessee and Kentucky. Failing at Shiloh, Bragg marched the greater part of the Confederate force to Chattanooga, which he made his *point d'appui* for operations looking to the same end. Buell, who had joined Grant at Shiloh, was sent with his army to capture Chattanooga; but owing to the long lines of railroads he was obliged to keep open to maintain his supplies, Bragg was enabled to secure a firm hold not only of Chattanooga, but upon the mountains eastward, to Knoxville, the ranges of which formed screens from behind which he suddenly burst, turning Buell's left and threatening his line of communication. On the first day of September commenced that memorable race for the Ohio River. Buell outmanœuvred his adversary and, finally, on the 7th of October, brought him to bay at Perryville, Kentucky, where, for the first time as distinct forces, these two armies,—that of Buell, now called the Army of the Ohio, but subsequently the Army of the Cumberland,—and that of Bragg, known to the Confederates as the Army of the Tennessee,—grappled in battle.

Following this occurred the battles of Stone's River, Chickamauga, Missionary Ridge, those on the Atlanta campaign, and finally that of Nashville, which closed the career of the Confederate Army of the Tennessee. With the exception of the Army of the Potomac and Lee's Army of Northern Virginia, no other two armies during the Rebellion had so long and so desperate a struggle.

The next paper will treat of the operations of the artillery in the Shiloh campaign of the Army of the Tennessee.

HOT AIR BALLOONS.

By CAPT. E. L. ZALINSKI, 5TH U. S. ARTILLERY.

THE impedimenta required for the gas balloons heretofore adopted for observation purposes in foreign service is very considerable. Particularly is this the case in the material and apparatus required for making the necessary gas.

The generator weighs 6100 pounds and is capable of generating 8750 cu. ft. of gas per hour. The steam windlass weighs 5500 pounds, and the balloon and wagon 4840 pounds. A complete balloon outfit therefore weighs about 16,500 pounds and requires three wagons for transport.

The English wagon, carrying tubes of compressed gas, weighs 43 cwt. and requires six horses to draw it.

The time demanded for filling the balloon is also a serious matter. The German apparatus, which is considered the best in use, requires two hours to get fully into operation.

Very many times it is desired to make only a brief observation, for which it would hardly be worth while or advisable, if avoidable, to expend the material required to make the gas. Cavalry on advanced guards and on reconnaissances would find it extremely useful to have with them, without serious impedimenta, the means for making occasional observations of the country from a considerable height. It might sometimes be used advantageously in Indian campaigning.

The hot-air balloons used by the acrobats in their exhibition ascents appear to have many advantages for this work not afforded by the ordinary gas balloon. The balloon, which will be described hereafter in detail, weighs only 165 lbs., complete with necessary ropes and parachute, and can easily be carried on the back of a single pack animal. It is inexpensive and simple. The furnace for the hot air can be improvised anywhere in the field. But as this requires about an hour to construct it would be possible to devise something which might be carried with other accessories on another pack animal, making two in all. With the furnace ready, the balloon can be filled and the ascent made in ten minutes from the time of lighting the fire. The balloon, it is claimed, can remain up one half hour; but if this is true for only

one-third of this time, it would suffice for obtaining valuable information otherwise unobtainable. There are, of course, limitations as to its use in unfavorable weather conditions.

Where the direction of the wind is unfavorable it is necessary to hold the balloon captive. This is not feasible for any extended period if the wind is very strong. In such cases a momentary ascent may be made and the balloon pulled down at once as soon as it has attained the height allowable by the length and weight of the anchoring cable. When the wind is in a direction away from the enemy, it is not, of course necessary to hold the balloon captive.

The parachute is attached to the bottom of the balloon, so that the observer may instantly detach himself by pulling a rope which operates a knife, so as to cut the rope by which it is attached.

The parachute at once drops from 50 to 200 feet very rapidly, when it opens and, swaying somewhat at first, then descends steadily and quite slowly. To avoid sea-sickness, attendant sometimes upon the swaying, the aeronaut avoids eating before going up. The rapidity of the rise, and distance of the initial fall up to the time of the spread of the parachute, is dependent upon the size of the "spreading" hoop held in the lower part of the closed parachute. This varies from two to eight feet in diameter and will be described in detail later on.

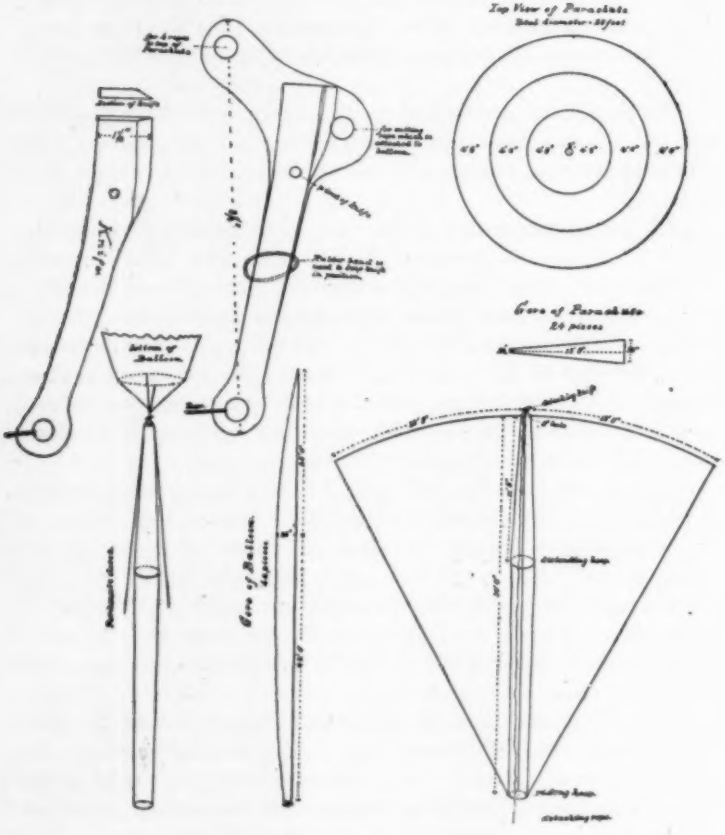
The aeronaut, if descending in a wood, or amongst houses, must be quick to seize and hold any branches or roof, inasmuch as the slightest check to the descent causes the parachute to collapse, and if he has not held on to whatever has been struck, his fall from that point will be as rapid and severe as if he had no parachute. There is no difficulty or danger where the descent is on terra firma, and still less if he falls in the water and is provided with a life-preserver or can swim.

It is of course desirable that the aeronaut should be quick and active. If so, the danger due to the descent becomes comparatively small. Herr P. Kyle, whose ascents I witnessed at Hot Springs, Arkansas, informed me that he had made about 100 ascents without having received any notable injury.

As soon as the parachute is detached, the balloon upsets, and the hot air pouring out, it collapses and comes to the ground very rapidly. To facilitate its turning over and emptying, a weight of about 15 pounds is attached about two-thirds of the distance from

the top, to one of the four guy ropes which are attached to the top of the balloon and hang down. Mr. Kyle used for this weight the canvas cover used in the transportation of the balloon.

It is perfectly feasible to introduce an attachment to the balloon by which the heat could be reinforced after the ascent has been made, and the time available for observation purposes could thus be extended.



DESCRIPTION OF BALLOON.

The balloon and parachute are made of rather light weight Wamsutta cotton, which is not prepared in any way by varnishing or oiling. The balloon when finished is about 60 feet in height

and about 38 feet in the maximum diameter. At the mouth it is about 13 feet in diameter.

The balloon is made of forty-two gores, each 68 feet long and cut in a half pear shape. The maximum width is 36 inches, at 26 feet from the apex. At 68 feet from the apex, the other extremity, the gore is 13 inches wide.

These pieces are sewed together first in pairs, so as to make single pear-shaped pieces. These, in turn, are united into twos and then in fours and eights, there being finally five pieces of eights and one piece of two. The eights are again united in pairs, and one of these with the width of two. These are all then united. In sewing together, they are first sewed by a seam one-half inch back, and then the edges are rolled over and whipped in by another seam.

Around the bottom a strip of canvas 10 inches wide is sewed in, enclosing a rope to which 4 holding ropes are attached. This rope is about $\frac{1}{4}$ inch diameter.

The top is also reinforced with canvas, and to this is attached an iron toggle for lifting and supporting the balloon whilst filling, as also four guy ropes; tapes 1 inch wide are sewed on circumferentially about 6 feet apart. Small holes are repaired by using a cement and patches. Larger holes are repaired by sewing on patches.

THE PARACHUTE.

The parachute is made of the same light weight unbleached Wamsutta cotton as the balloon.

Twenty-four breadths are used, each being 14 feet long, 33 inches wide at one end 2.5 inches at the other.

The seams are made double, so as to permit a cord to be passed into each seam.

An 8-inch opening is left at the centre of the parachute, and this hole is bound with leather. A small rope grummet is bound in the edge of the hole, and four pieces of rope, about 8 inches long, are attached to it. To these four pieces, the detaching knife is fastened.

Four ropes about $\frac{1}{4}$ inch diameter and 30 feet long are attached to the central grummet.

Also a small cord ($\frac{1}{8}$ inch diameter and about 33 feet long) is pulled through each seam, and is then long enough to reach the riding ring.

These small radial ropes and the four central ropes are attached

to a wooden riding ring about 18 inches in diameter. The hoop is covered with cloth and has four rings, by which the four large ropes are attached by a spring snap, the small ropes being permanently fastened to the hoop.

At about ten feet from the top, each of the four ropes has attached a spring catch.

The "spreading" ring is a wooden hoop from 2 feet to 8 feet in diameter, and having 4 iron rings about 1.5 inches diameter attached at the extremities of two diameters. These serve to hold the hoop between the four ropes, so as to give the parachute an initial spread, and thus facilitate its distension. The edges of the parachute are taped, and the seams are reinforced at the edge by short pieces of tape about 3 inches long. Besides this, two lengths of the lacing tape are sewed circumferentially, equally distant between the edge and centre. This brings them about 4.5 feet and 9 feet from the centre. In sewing these on care should be observed not to close up the opening in the seams left open for the free pasage of the radial cords. The parachute complete weighs 29 pounds.

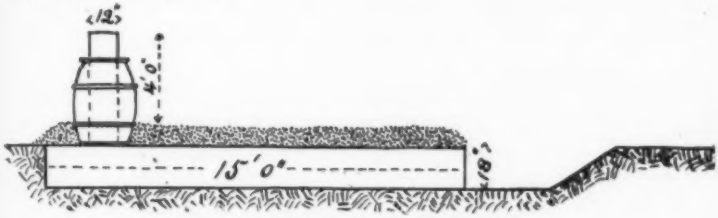
THE DETACHING KNIFE.

This can best be understood by reference to the sketch. It consists of two pivoted pieces, attached to the parachute so that upon pulling, by means of a cord, one of the arms, it cuts the cord by which it is attached to the balloon. A small rubber band holds the knife arm in place against the rope to be cut until it is cut. The other arm has two holes, through one of which the rope is passed, tying it to the parachute; through the other the rope passes which fastens the apparatus and consequently the parachute to the balloon.

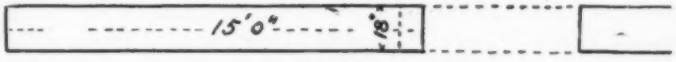
THE HOT AIR APPARATUS AND METHOD OF USE.

This usually consists of a trench in the ground about 18 inches wide and deep and 10 to 15 feet long. It is covered over with a piece of sheet-iron upon which earth is piled. Left entirely open at one end, a sheet-iron pipe about 12 inches diameter is placed at the other end which is otherwise closed. This pipe rises about four feet and an ordinary flour or sugar barrel is placed around it, the intervening space being filled with earth. The object of this wooden jacket is to prevent the balloon from coming in contact with the hot iron pipe. The iron pipe is usually made of a

piece of sheet-iron, bent into a cylinder and kept in shape by pieces of wire. The following sketch represents the arrangement of the furnace, etc.



HOT AIR FURNACE TRENCH.—SIDE VIEW.



TOP VIEW.

The ash staves of a barrel are used by Mr. Kyle in preference to pine for making the initial fire. These are piled up at the mouth of the furnace; being lit, a smart fire is started. When this is well under way, kerosene is thrown on the fire, a pint cup full at a time, until about two gallons have been used. Gasoline, naphtha or alcohol is then thrown on in a similar manner until the balloon is fully inflated.

Previous to the firing, the balloon is suspended by means of a cross line passing through the toggle attached to its top, until it is raised about 30 feet. This cross line may be fastened to two trees, or in their absence to two poles suitably guyed. The mouth of the balloon is placed over the chimney of the furnace and well spread. A man is placed inside of the mouth with a bucket of water, to put out any sparks that may enter and attach themselves to the balloon. He also reports if the flames rise too high when the gasoline is being used, and the rapidity of use of the latter is governed so as to prevent them from doing so.

About 3 gallons of gasoline are ordinarily required. If alcohol is used a less quantity is required.

The sides of the balloon are held distended by a number of men equally distributed around the balloon and holding on to its sides. They gradually release it as it fills, allowing it to rise. When completely filled, it is allowed to rise, being held by the four guy ropes so as to free the parachute, the latter being previously laid out on the ground. The aeronaut, fixing himself in the riding hoop, then gives the command to "let go."

RUSSIAN VIEW OF THE PAMIR QUESTION.

By "ALASK."

CENTRAL Asian questions are again interesting the press in America as well as Europe, and it seems opportune to set forth the Russian version of the most recent phase of this ever recurring subject.

Telegrams from India and London every few days tell of incidents in the Pamirs. This shows the uneasiness and displeasure produced upon the English by the movements of the troops under Colonel Donoff. The alarmist article of Professor Vambery in the *Neue Freie Presse*, Vienna, and the tone of the English press are already known. As far as observable the French press, which latterly treats more seriously and attentively events in the far East, has this time limited itself to rather short comments, for the greater part confused and contradictory. *Le Temps*, however, has printed two rather long articles concerning the collision on the Pamirs, and this journal is unable to account for the appearance of the Russian troops on the headwaters of the Amoo-Daria. It apparently considers the troops of Colonel Donoff, consisting of several hundred men, as an escort to a scientific expedition.

In fact, the affair has passed the stage of scientific explorations which were made by Poutiatoi, Ivanhoff and Grombchevski, and it is now a question of establishing Russian authority in a country which has belonged to it since 1875, but which has not been occupied until it was needed. The troops of Colonel Donoff consist of all arms of service.

Superior right to the Pamirs came to the Russians with the conveyance of the Khanate of Kokand. Up to the fall of Kokand, the Emir of that khanate was the sole possessor of the Pamirs from Alai Mountains to the khanates Kunzoot and Yassen, situated on the foot-hills of the Himalayas—from Kashgar in the east to Badakshan in the west. The details of this are seen in a report made by Grombchevski a few years since to the Imperial Geographical Society. As far back as 1872 the zones of political influence of Russia, Afghanistan and East India, were designated by the St. Petersburg and Russian State Departments.

The Indian Government, supporting its ally, the Emir o Afghanistan, permitted the deposition of the Kahn of Badakshan, although such action was in violation of an agreement. After the conquest of Kashgar by the Chinese, undoubtedly instigated by the English, the former moved slowly out of Kashgar on to the slopes of the Pamirs; and the Afghans, in their turn, began to harass the small mountain khanates of Vakhan and Shugnan. At the same time in the South the English strengthened themselves by garrisons constructed at the important points, Konzoot and Yassen. Grombchevski found, on his last scientific travels, that, on the Pamirs in a southern direction from the Trans-Alai range, there remained unoccupied only a narrow strip; the remainder was held by Chinese and Afghan advance posts.

During all this time the English were making further reconnoissances (Captain Younghusband, Littledale, Davison and others). These reconnoissances, under the appearance of hunts, are still made.

These circumstances induced Russia to send troops to the Pamirs in order that upon the appearance of the Russian flag its right to these elevated plateaus might be affirmed. Although the Pamirs, in consequence of their barrenness, present of themselves no specially tempting fields, nevertheless there is no reason to yield to the English or their allies, since every concession, whatever be the motive, is considered by Asiatic peoples as an indication of weakness.

The troops of Colonel Donoff, as seen by the short telegraphic reports, very quickly and effectively cleared the territory of the illegal Chinese authorities situated in the sparse settlements of Eastern Pamir. The Chinese fled at the first demand; with the Afghans it was a question of shedding of blood. The small advance guard of Donoff was met on the Alichur-Pamir by shots; part of the Afghan garrison was killed, part was captured. Thus the Afghans received a second bloody lesson at the hands of the Russians; the first was in 1885 at Kushka. This may possibly teach them to act more cautiously concerning the counsels and motives of the Indian government.

At the time of the Kushka affair there was a great cry in London; immediately afterwards followed the delimitation of South Turcomenia and Herat—provinces obtained by conquest—up to the Amoo-Daria River. Incidents of latter years on the Pamirs show that the English consider that at present the frontier

on the southeast of Turkestan is insufficiently determined, and they will probably again come forward with persistent propositions to divide the Pamirs amicably. At the present time they are acting through the Chinese minister, but with China it is to be supposed that the affair will proceed very slowly, as the Pamirs are of no special interest to it.

As regards the Afghan Emir, he is less inclined than ever to enter into a decisive struggle with Russia. War with the Khazars, and disorders in Afghan-Turkestan, have caused serious difficulties within his State. In a telegram from Simla it is stated, that although the Emir does not ask aid of the English, yet, considering that the supervision of exterior questions is in the hands of the British government, he requests immediate counsel as to what to do, as he cannot permit his troops to suffer defeat a second time by the Russians. From this short telegram it is clearly seen that the Emir is in great anxiety and casts all responsibility upon the English, for he dare not engage in an offensive or a defensive war against the Russians on the Pamir.

From latest information the troops of Colonel Donoff have been reinforced and will pass the winter there.

It will be difficult for the Emir to show any right whatsoever to the Western Pamir, as well as to his occupation of Badakshan, done, as said above, in violation of agreement. Further action of the Afghans in Shugnan and Vakhan only reveals their perfidy. It will be still more difficult for the English to formulate their pretences, as they have never yet thoroughly established their authority in the khanates of the Himalayas between the Pamirs and Kashmir.

Thus, there is full reason to hope that Russia's right to the Pamirs will be shown and recognized.

SOME COMMENTS ON MILITARY SPECIALISTS; AND THOUGHTS ON THE TRAINING AND EMPLOYMENT OF SOLDIERS.*

By CAPT. FRANK W. HESS, 3d U. S. Artillery.

JUST all that was meant by the genius who invented the phrase "Piping times of peace" is hard now to discern. The sentence is a happy one, has long survived its author, and is found ready on the lips of speakers and at the pen-tips of writers who feel the necessity for a phrase to indicate that blissful state of existence which it is supposed to so fully describe. May he not have been in a facetious mood, and might he not have meant to describe the conditions which exist where war, stern and dreadful war, is in the distant past or in the hazy future only, and the incipient and unfledged warrior has commenced to "pipe" on theories about it, and continued until the air was all ajar with new and discordant ideas?

Many of us remember when "long range and rapid fire" had been attained by the infantry, how the theorist tuned up his pipes and proved to his own entire satisfaction that the days of field artillery had been numbered, and that cavalry, that grand arm whose knightly and heroic mission it has ever been to make the first sacrifices in war, would not again be found on any battle field. But while he was "piping," others of a different mould were at work experimenting, with coats off and sleeves rolled up, making guns and ammunition and training the minds of men to methods to meet the changed condition of things. He "piped" away however until 1870, when armies appeared along the Rhine as if by magic, and the splendid German artillery and active and alert cavalry under the command of practical soldiers, most of whose names were unknown in military literature, crossed it, and in a few brief weeks drove the French out of France and our piper out of court.

But much of this theorizing we indulge in now is not an unmixed evil. Widely divergent and visionary as are the views expressed by the young doctors, and some old ones as well, it

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must be gratifying to the sovereigns whom we serve to note this intellectual activity. Our theorists and specialists are not lazy; they are active in their way, and the facility with which many of them drop their theories and the tenacity with which they hold fast to that which is good, when they once find it, makes one feel like forgiving them.

The field of range finding is one into which the inventor and theorist has entered with a will, and as a result we have dozens of methods for range finding and position hunting, and as many different instruments.

Against the usefulness of many of these for sea-coast warfare we have nothing to urge, but our enthusiast will not stop here; he insists on accompanying armies in the field with a more or less expensive and cumbersome plant, and states that he can obtain ranges with such precision and celerity that our guns may be loaded and fuses set in some sheltered depression, and it remains for the cannoneers only to push the carriages to the front, take the elevation for the instrumental distance given and annihilate the enemy.

The practical objections which conservative men have urged in recent discussions of the subject against placing much reliance on any of these instruments are, among others, these:—In whichever of the dozen or more forms they appear, they require, always, a clear field to work in. Smoke, either artificially created for veiling purposes or that naturally produced by the explosive agents used, a fog, or a "dull, grey day," are fatal to them. They require the services of men and officers specially trained at the expense of much time and practice, who could often be used more effectively with their batteries. Like all fine mathematical instruments, they are easily put out of adjustment by the necessarily rough usage of campaigning, and then they would give wrong ranges. The men using them may mistake the object to be fired at and thus deceive the gunner, or make errors in manipulation and thus get incorrect results. But assuming that these instruments are, as a class, absolutely correct and are faultlessly manipulated, they only give the range in yards or metres, and every artilleryman knows from work on the practice ground, that *that* is not what he needs to know, so much as what elevation to give *this* gun with *this* powder, under *these* atmospheric conditions. That the errors these instruments make are small ones, argues nothing in their favor. Falsehood which comes very near

the truth is not so readily perceived, and, on that account, is often most dangerous. So with these contrivances. When the error is small it will be detected with difficulty, and our bursts being 50 yards over, or a hundred too short, the error though trifling, measured in yards, will be most fatal. This will be particularly so at the long ranges where the angle of fall is considerable. Ranging with the gun by the bracket system, until some better is devised, will therefore always be necessary after the range finder has finished his work.

That the battery commander who finds himself afield in a campaign without these interesting instruments may not entirely abandon hope is illustrated by the campaign of 1870. In that campaign, which did more than any in the history of wars to educate the world to a proper appreciation of the value of our arm, little or nothing was heard about a range finder other than the gun itself. This is a very important fact, and has a value far beyond the theories of any enthusiastic inventor.

Then we have the search-light enthusiast, who proposes to turn night into day by lighting up the field with electric lights in a manner that will shame the sun himself. But this poison has found its antidote in the "hair of the dog," and we have now the battle of the lights where light fights light, and either side arranges to be unobserved by the other when it chooses.

But the specialist is not an unmixed evil. What we want to do is to prevent him from spreading himself all over the army at once. Let us appreciate for what it is really worth that common sense which teaches us that an artillery sergeant cannot be a mechanical engineer, an electrical engineer, a surveyor, a meteorologist, an expert telegrapher, and a soldier at the same time.

We can listen patiently to what he has to say, but let us not be carried away by his enthusiasm so far as to forget some of the simpler practical things which lie at the bottom of all military success.

War is, after all, a certain application of the forces of nature to accomplish a given purpose. When, as a Cliff Dweller, on the precipitous edges of the great mesas or on mountain tops, he piled huge rocks and logs to roll down on his assailants, man availed himself of one of her forces, gravity; when armed with the club he added another, the lever; these with others he combined in the catapult and bow.

But while Cain with the bludgeon or stone must perforce do

his murderous work, modern man has stretched out the arms of his intellect, has wrenched from nature, through the chemist's art, many of her choicest secrets. From the clouds, too, he has taken the lightning, making it subservient to his military purpose, and has thus armed himself with a power with which our ancestors only clothed their gods.

But there are other forces found inherent in man, most potent in war, for which neither the chemist, electrician, nor mathematician can give us an equation. It is his moral condition. He is brave, courageous, full of valor; resolute, bold, dashing; full of confidence and self-reliance; he has great heart, or, he exhibits himself through all the gradations of timidity, down to abject fear, when like a dung-hill cock he is ready to skulk and sneak away. The crack of a gun then jars every nerve. His heart is gone. These are evidences of what military writers are now beginning to call his psychological peculiarities; to manage and control, in this respect, is one of the profoundest studies of the tactician.

While the bludgeon of our remote, and the short sword and javelin of our more recent ancestors, have been supplemented by the tools and appliances of our cultivated age, the animal man is, after all, the animal still. The same passions have their home in his breast; the same impulses control his actions. Cain, be he Emperor of Germany, Ruler of France, or Czar of all the Russias, through jealousy or revenge, still kills his brother. Fear of death or disaster shatters his nerves. As of yore, he has but one life to give, and this he guards as jealously now as when he fled, naked, through the forests, seeking safety from the pursuit of the lion, the tiger or the bear. When assembled now in the huge masses called armies, the large companionship and confidence in his skill with his weapons gives him courage; but this same companionship and the sudden discovery of the unexpected in his antagonist often creates panic, and he flees from the enemy, and, for the time being, though he be clothed in scarlet and gold, he is the same terror-stricken wretch that skulked, naked, or clad in skins, among the reeds and brambles of old Nile a thousand generations ago.

It must be noted, however, that in some other respects, our animal has changed. There has been a great development of the intellectual. He is less easily deceived. He thinks more, and when he thinks he does it rapidly, and draws conclusions quickly. This has enhanced his individuality and rendered him less liable to that perfect surrender of himself to the control of another, which we

call discipline. There may have been a time in his history when he went because he was told to go. He does *now* sometimes, but it is not safe to wholly rely on that for obedience. If, when the command comes, there comes with it conviction that the order is the proper one to accomplish the object in view, feet and hands act in unison with his heart, and his task is half accomplished in the beginning. His education, preparatory to war and association with his commander, has much to do with this. When the members of the orchestra perceive the tuning of all the instruments under the supervision of the leader, they expect only what they get when the overture commences—harmony.

The increased fire effect which has been given to a defensive line since the termination of our great war in 1865 can be brought home to us, by reflecting that a line composed of 100 men could deliver during one minute of the advance of an equal attacking force 200 bullets or about two bullets per man per minute. An expert man can now with the ordinary single breech-loader fire about twenty in the same space of time, and with a magazine gun this number can be greatly increased. At the double the advance is at the rate of 180 yards a minute. The gait at which assaults and short rushes will be made will perhaps be such as to carry the attackers 200 yards per minute. During their passage over a space of 200 yards then the assailants will receive 2000 shots instead of 200 formerly. Putting the percentage of hits at the extraordinarily low figure of five, with the old arm ten hits might be expected, and with the new 100, or one to each man of the attacking force. In passing, and in connection with this subject, I wish to say that some little experience I have had in trenches and behind breastworks, leads me to wonder why a rest for the rifles of the defenders is not recommended. That is, such a shape given to the superior slope of parapets as will give the defenders' guns, when lying on the parapet, the proper elevation and direction to enable them to cover the space in front, up to say 400 or 500 yards, without aiming. The trouble I have noticed is that men will not rise far enough above the parapet when it is swept by fire to take aim. I have seen them firing into the air rather than expose their heads.

This tremendous volume of fire from a defended position awakened the piper again, and this time he came with his little lead soldiers and his maps and his table of probabilities and his dice-box, and proved, what? Only that the lead soldiers could

never make a successful frontal attack, that the volume of fire was so great that cavalry in column of squadrons at the full charge, though the length of column be indefinite, could never approach within the 200-yard zone so long as the defenders' cartridges held out. This Kriegsspieler was nearer being right than many of his fellow-pipers; but while the lead soldiers implicitly obeyed, they also passively obeyed. No heart-throbs sent the blood tingling through arteries and veins carrying courage to the brain and swiftness to the feet. No shout went up from them that created the terror and dismay in the hearts of the assailed which unseated judgment and rendered their fire harmless. The passions, the impulses, the hopes, the fears of our animal were not there; and no man is so skilled that he can represent the effect of these on the battle-field by any system of tables of probabilities.

Invention of new fighting machines, all progress of science as applied to war, has not changed certain characteristics of the animal we are to lead to battle. Notwithstanding long ranges, flat trajectories, rapid fire, electric lights, range finders, and smokeless powder, it is safe to assume that dynasties will not be unsettled, boundaries destroyed or empires founded by long range fire. Time was when the great-hearted leader, snatching from its bearer the emblem of his clan, his principality or his home, rushed amid the foe and dared, not in vain, his followers to keep abreast of it. Has this time passed to return no more? Our arithmetic says it has,and that the regime of long-range-magazine and machine-guns proclaims a new era. This being so, it calls at most for changes only in the management of our animal on the battle-field, for the enemy must be gotten at as of old, and personal contact made in order to insure decisive results. The bayonet has not passed into history. Surprises, the minor surprises of the battle-field have of late been more common. The smokeless powders will contribute greatly to these. The battle-fields of the present and future, as indeed have done some of those of the late past, instead of presenting one great tactical problem to be worked out in all its details by an army commander, as in the days of Frederick, of Marlborough, of England's greatest duke, will present a thousand problems in minor tactics, and on their rational solution will depend victory or defeat. Events have thrown a great responsibility on the subordinate commander, but in compensation for this, history of battles furnishes no such tempting

rewards to the subaltern leader if he has intelligence, pluck and perseverance, as those now held out. More than ever is it now possible for a score or two of riflemen, well hidden in a wood or defile, or hurried at the proper moment to some wall, railroad-cut, sunken road or other cover, to open a fire, the effect of which being seized upon by others, might lead to most decisive results. The same is true of a battalion or squadron of cavalry, especially if armed with a view to getting from it the best *fire effect*.

For the keen-sighted and quick-witted battery commander there is fame galore. The quick perception of an important objective, and getting its range quickly, is of enhanced importance. This ability to see rapidly and locate objects properly, and estimate distances correctly, I am persuaded is a "gift," though much can be done to cultivate the faculty. The difference in the ability of average men to see is not perhaps so great, but there is a wonderful difference in their ability to perceive or mentally digest the pictures left on the eye. There is often a lack of coördination between mind and eye, causing sluggish mental perception, and this in men who are otherwise brilliant. In almost every command some few men can be found who are remarkable in this respect. They should be sought for, as they are most valuable to a captain, and should have some duty always near him.

The relationship that exists between the different arms has been knit closer by the increase in power and range of fire-arms. The "caste," about which Prince Kraft wrote one of his letters on artillery, has disappeared largely from the profession. Surely there is no rivalry now or should be none between the infantry and artillery, except that healthy emulation which causes each to try to excel the other in loyalty to duty, each in its particular sphere. If they ever did so, artillerymen no longer claim that they alone win battles, but concede that decisive success can be accomplished only by good infantry. We have accepted our position on the battle-field, which is a secondary one. When properly there, we are there to assist others to victory by making the rightful preparations for their assaults.

It is now conceded that the artillery should be well to the front, and early on the line, and so placed that its fire can be concentrated on that portion of the line selected for the assault; that its usefulness should not be frittered away by distributing its fire on different objects; but that when used at all an effort should be made to make its effect overwhelming, crushing, so

that the enemy receiving it should handle his own arms badly, lose heart and confidence in his officers who placed him in such a position, become demoralized, and finally think only of hiding himself from its searching effect. When this occurs then is the time for the infantry to advance and "fight to a finish." Man has only a given amount of nervous energy—that most potent factor in battle—on tap; when that is exhausted, unlike his cartridge box, there is no company wagon at hand from which it may be replenished. It takes time to do this, and that is just what we must not give him if he is an antagonist.

It may become (indeed on account of the nature of modern deployments, it will become) the duty of artillery, regardless of losses it may be suffering from that of the enemy, to continue its fire on the hostile infantry, in order to enable our own to secure a foothold on some key-point of the field. This is the most difficult duty we can ask of a soldier, as the impulse of self-preservation always inclines him to fire at the people who are making a target of him.

Since Gravelotte, and the action in front of St. Privât on that memorable 18th of August, 1870 (St. Privât should be a saint henceforth in the artillery calendar), when from 6000 to 8000 of the flower of the German infantry were lost in a few minutes in an attack on that village, because of lack of artillery preparation, and succeeded, with comparatively small loss, when, afterward, the artillery did make the preparations, our infantry friends the world over have appreciated us for what we are worth when properly used. Rarely do we find one now who really believes that success in the frontal attack without our aid in its early stages is possible. It needs, I think, no argument to prove that perfect concert of action is necessary to assure success, and it follows that the general tactical idea of each arm should be understood by the others. Infantry tactics should not be despised by the artillerist, and consequently the drill book, which is, so to speak, the A B C of that tactics, should be well understood.

The tactics of the defense does not seem to have changed so much except in the more general and larger use of cover. Positions are selected with a view to the better protection of flanks and to greater command. The object is still, as it always has been, to produce the greatest volume of fire with a view to its easy concentration on the portion selected by the assailant for attack.

About the tactics of the attack, much theorizing and experimenting has occurred. The leading military powers of Europe have greatly modified or changed their drill regulations, even since the introduction of smokeless powder and small calibres, but nothing entirely satisfactory has been arrived at, simply because all systems need the seasoning of actual war. Fighting a marked enemy, or attacking a friendly corps when we know he is only using blank cartridges, is mimicry of war, and is not conclusive. There is an absence of the moral effects which an enemy's bullets would produce that we cannot measure. When they are present there, conclusions on these matters may be shown to be erroneous. There are some things however which seem to be finally settled, and one, about which the least doubt now remains, is that troops in the ordinary marching formations, in masses, or in any close order formation, cannot be handled within the zone of effective infantry or artillery fire unless greatly favored by broken ground or artificial obstacles, such as houses, walls, etc. Skill in the use of ground, as we find it, is another point. The commander who best understands this art, will have a great advantage over his antagonist. This brings us to another point—the paramount importance of thorough reconnaissance of a position before the attack is made. There should, after the attack has commenced, be as few surprises as possible for the attacking forces, and they should never come in the form of unexpected ditches, hills or folds in the ground, into or from which sudden volleys may come. There should be no unexpected "Devil's Dens."

To examine thoroughly as to all these things, and as to points on which the enemy can most easily bring an effective converging fire, requires the greatest skill and the quickest perception. The report of the scouting officer or the patroling officer is fraught with an importance hitherto unknown, from the fact that when troops are once fairly committed to a line of attack, manœuvring into some other position is well-nigh impossible. This is the stream in crossing which one cannot swap horses. Special attention should be given to training for this, and only those who evince the readiest perception and soundest judgment should be continued in that training. Those only who seem to have a special aptitude for this kind of work should be retained for instruction and practice. The responsibility thrown upon these officers is very great, and the commander who is true to himself and his command will be very exacting in his demands of them.

If smokeless powder has come, as they say it has, to stay, this examination of the ground may be less difficult; but to remember what one has seen and to paint it by words or pencil so that the picture will appear in the mind of another precisely as it does in your own, requires a skill that does not exist without training.

Grand old Farragut could say, "Damn the torpedoes; go ahead," but the commander ashore who, in the face of unshaken infantry fire, attempts to imitate him, has prepared a big surprise for those who furnish the sinews of war for him. The spade, the hitherto plebeian spade, has, by the increased fire effect of the fighting line, been dignified by promotion to the rank of an arm.

For those who are even temporarily on the defensive, awaiting attack, every advantage of cover which the spade can give must be utilized. Its usefulness to those who occupy some key-point on a line, need not be dwelt upon. The tin plate or half canteen which figured so conspicuously in the War of the Rebellion as improvised intrenching tools, will no longer answer the purpose: for, owing to the increased power and ability of the musket-ball to penetrate, a greater thickness of parapet is necessary, and the work must be done quickly. A parapet of much less than three feet of ordinary soil is not safe. To the troops of the attacking party the spade will be equally valuable; they will frequently find themselves in positions where, to hold the point gained until strengthened by other subdivisions of the echeloned line, artificial cover will be indispensable. In frontal attacks it will frequently be necessary to intrench temporarily, in order to add to the efforts of the artillery to keep down the enemy's fire, while supports or reserves are being forwarded preparatory to the final push.

This tool, however (I beg its pardon, I mean this arm), is one which can be and has been abused. It is the arm *par excellence* of the subaltern or group commander, and great caution should be displayed in its use. Sound judgment as to the time and place for using it is indispensable. It is the arm which if properly used will assist most in preserving that desirable psychic condition necessary to success. To ask men to expose themselves needlessly is to destroy their confidence often in the leader, and when this is gone all hopes of success vanish with it.

If he is skillful, and above all has his hand on the pulse of his command, is in touch with it, its moral or psychic condition will be known to him, and whether he can urge it a few steps further

or whether he must stop where it is, will make itself apparent to him.

Men must be drilled into the understanding that the shelter-trench is in no sense intended as an obstacle against the advance of the enemy, further than their fire will be an obstacle.

When you commence making something that will do more than that, you are at the same time putting difficulties in the way of your own advance. It is to be resorted to only when natural or artificial cover is not at hand to shield the men while they are firing; and one of its best claims to usefulness is the facility it affords for steady aim, as a man lying in one always has the advantage of a "rest" when he aims. Men should be taught to construct them with great rapidity and in a uniform way, so that if the necessity for strengthening them arises the work can go on without undoing that which has been done. Too much stress cannot be laid on the importance of impressing upon the men the fact that they are for temporary occupancy only; a place to take lodgment in, as behind a tree, a stone fence, or in a bit of sunken road, the better to direct fire from until the time is ripe for a further advance. In that stage of the battle wherein the assailed makes his counter and the conditions are reversed—the assailant becoming the assailed—how invaluable will these intrenchments become in breaking up his attack while our own reserves are hastening up to make sure of a decisive ending to the fight.

They would be particularly useful at this stage, as the close proximity of our own and the enemy's troops renders the friendly artillery useless. It cannot fire for the moment without endangering friend as well as foe. Again in the frontal attack—from which, unaided by a flank attack, success cannot now be hoped for, unless we greatly outnumber the enemy—if our artillery is performing its function, viz., concentrating its fire on that portion of the line selected either for assault or pretended assault, a lodgment may be made inside the 400-yard zone, and, once made, then held as a menace, keeping the enemy there and well down by fire from the trench, unaided by the artillery which has become engaged with that of the enemy, with a view to protecting itself or preventing him from using his against other infantry deployments for the real attack, now going on on an adjacent part of the field, perhaps his flank. If this succeeds, and he is shaken from his holdings, the troops sheltered in his front are in fine position for advance and pursuit.

The same objections do not now exist as in the days of the "Thin Red Line" and the onslaught of dense columns. The regiment when deployed was in one line. When it halted and lay down, as a rule there was nothing in rear to give it impulse forward.

I have myself witnessed the great difficulty of getting men to rise and advance after they had lain down in an attack. The most notable example was at Petersburg, Va., when the mine under the defenders' redoubt was exploded. The explosion was a perfect success, and to the enemy a perfect surprise. The troops selected for the assault were in place and moved forward at the appointed time, clearing the abbatis in their front, but, as the style was in those days, in one line. During the consternation produced by the great upheaval of earth, they rushed forward, gained the crater, and there for some unaccountable reason halted. During this halt the enemy's supporting troops commenced to deploy and fire.

The assaulting line had lain down in the crater. They were colored troops; and though a most heroic example was set them by their officers (and among the subalterns of this brigade there were many who bore the most distinguished New England names), they were immovable, and hugged the earth like reptiles, remaining there to be captured or shot down like sheep. This was simply the result of bad tactics. If after lying down, an impulse forward had been given by other troops charging through them, there can be no doubt that they would have gone along. These affairs are managed differently now. Some modern writer graphically likens the attack of the echelons, when properly directed, not to the waves of the ocean, beating successively against the shore, wherein wave follows wave, the first expending itself and receding towards the sea before the second comes, to have its force half overcome by stemming the backward flow of its predecessor; but more like what happens when a river is dammed, and increment is added to increment until at last the ever accumulating force breaks down the obstacle and sweeps all before it.

As it has been said before, the responsibilities thrown upon the subaltern commander are infinitely greater, while opportunities for performing those distinctive services which may give his name to history and fame are infinitely increased. Deployment, a hitherto simple thing, accomplished by any method that would

quickly change a column or mass formation into one in line, has become a most dangerous and delicate operation.

To break up a command into the small fractional parts, made necessary by long range and rapid fire at one and two miles from the enemy's position, and at the same time maintain throughout the advance and the fight, that cohesion of the parts which enables the main purpose and direction of the action to be under the control of the senior commander present, is the problem that will confront every corps, division, brigade and regimental commander on every battle-field of importance.

It confronts with equal seriousness the commanders of subdivisions, be they battalions, companies, half companies, sections or squads; for the success or safety of each depends on the cohesion and coöperation of all.

While the Germans in the Franco-Prussian war brushed away much that was false, which had grown up during peace—military absurdities always flourish then—and solved many problems that will always be of great benefit to those who play at the dangerous game of war, this is one with which they wrestled not so successfully.

As far as I can see, their deployments under fire ended in a confusion on the fighting line which was least desirable, and in the early engagements, including those of August 16th and 18th in the neighborhood of Metz, their success was due more to the faulty and hesitating tactics of their antagonists than to the excellence of their own; and recent German military literature emphasizes the fact that none appreciate more fully their shortcomings in this respect than they themselves.

Gravelotte was a great battle, a great victory, and is graven on the German escutcheon only under that of Koniggratz; but unlike Koniggratz, was purchased at a price which deluged the Fatherland *unnecessarily* with the tears of mothers, widows and orphans.

The drill regulations for our army, now about being introduced, makes it possible, for the first time in many years, for commanding officers to apply the principles of modern tactics in the daily drills and exercises of troops; and here is where these principles should be learned. Hitherto this has been possible only by introducing unauthorized exercises.

So far as drill regulations for infantry are concerned, we are now fairly abreast the times, and there is work, intelligent and useful work, at hand for our brethren of the infantry.

The grand underlying principle is the greater division of the work, the greater extension of responsibility, downward through the hierarchy of command. The assistance rendered by the lieutenant to his captain, either in attack or defense, need no longer be limited to waiting till the latter is shot, as his duties are fairly well prescribed. His functions are those of an assistant in the best sense of the word, and frequently that of a commander; and, as shown before, the share he may contribute to the success of his cause may be incalculable. The sergeant and corporal as section or group-leaders are less important only because their commands are smaller.

The story of *Gourni Dubnik* should be graven on the memory of all leaders of small bodies. It was one of the little villages environing historic Plevna. It was on the Sophia road in a little valley, and its defenses were earthworks on steep heights near it. There were two principal redoubts; and about one mile from their flanks, two smaller ones for flanking purposes. All were combined by trenches with shelter pits in front, and at their extremities covered by wire entanglements. The whole was garrisoned by 12 battalions of Turks. The small redoubt on the left made rather a poor defense, and by 11 o'clock in the morning of the day of the attack the Russians had carried it.

But the captors found themselves under the fire of the principal redoubt. This they attempted to capture by a regiment which advanced under cover part way, but suffered greatly, and was repulsed. The attempt was continued all day; and in the evening, though 24 battalions of the Guards were engaged in the assault, nothing had been gained, and the order for retreat had been given.

Taking advantage of the growing darkness, a little detachment of a dozen men slipped along the ditch of the road and crawled into a little house and mill which stood in the outskirts of the village. This was but a short distance from the redoubt. They were followed by others, and soon a considerable body of Russians were in the dead angle of the ditch. The fire of the attack from other parts of the line kept the Turks off the parapet. The Russians cut steps in the outward slope, scaled it, and rushing in, the Turks commenced surrendering, and by a little after seven in the evening the play was over.

The mysterious and powerful influences which the born commander exercises over the commanded have ever been

fruitful themes for poets, orators and hero-worshipping biographers.

This ability to command, to inspire confidence, to establish that mysterious relationship between himself and his followers, which manifests its presence in all well-led commands, is no longer the function only of the corps, division, brigade or even regimental commander. The changed conditions of battle have removed all these from the immediate presence of, and personal contact with, the soldier. It is the captain, the lieutenant, the sergeant, and the corporal to whom he now looks. It is the integrity, the skill, the judgment they display in executing orders that impress him, and maintain or destroy that psychological equilibrium which makes him forget self in the great work before him.

My own experience in the field, as well as some knowledge gained in reading, confirms me in the opinion that many of the seeming mysterious successes of war, which have made men famous and created for them the reputation of being born leaders of men, have grown out of a belief possessed by those whom they commanded, that the commander was competent, educated, skilled in the practical things of war. An illustration abroad was the intrepid Skobeloff, a master of details, the hearts of whose soldiers were bound to him with old Polonius' "hooks of steel."

What made McClellan, in the early part of the war of '61–'65, the idol of the Army of the Potomac? He brought no great name, no renown. He was, so far as the people who composed his army knew, the average army officer. It was faith in his ability, engendered by the organization which he brought out of chaos. He knew how; and his men found it out.

What made every officer of the regular army, who treated the raw levies who rushed to the field with consideration, manly dignity and kindness, almost an idol? Simply their faith in his ability.

Much of this faith can be stored up among those we command in peace times and during the immediate preparation for war, and it will be found a most valuable reserve to draw upon. It has been wisely said that it is hard to deceive children. It is harder to deceive soldiers into the belief that you like and trust them when you don't.

If an officer persistently dislikes and distrusts soldiers, they know it, no matter under what form it may be disguised.

One who loves and trusts, may occasionally be mortified by

being deceived; but that is all, and his rewards greatly overbalance this.

I have thought sometimes that there were officers who had a natural antipathy to soldiers. If such there be, my experience impels me to say to them "seek not fame at the cannon's mouth."

The increased importance attaching to the non-commissioned officer as a section or group leader demands that he should be thoroughly educated in the practical things within his sphere.

There should be to him no mystery about the arms or tools he uses. Of their capabilities he should be a professor, a doctor.

He should be a master in improvised field fortifications.

Thickness and height of parapet for a given purpose, depth and breadth of ditch, amount of earth required, and time allowed for its construction, the tools to be used and the number of men who can work to best advantage, should be as familiar to him as were the Psalms to Cromwell's army. He should be a Doctor of the Shelter Trench. Above all, his opportunities for command and as an instructor should be frequent, constant; that he may impress on his little command his personality, his fitness, and establish a claim to its loyalty and confidence; or exhibit his unfitness to his superiors.

In conclusion, I beg to reinforce some of the ideas I have tried to express, by quoting from that distinguished and practical English writer, Major-General C. B. Brackenbury, a few lines as given in the preface of one of his books. He speaks of two principles as the "Mother ideas of the whole military art. First: The whole art of strategy and tactics is summed up in the principle to be superior to the enemy at the right time and place. This superiority may be that of greater numbers, superior skill, better physical condition, or higher moral tone. Second: Soldiers are not machines, but human beings, with legs and stomach and nerves and a moral sense. It is necessary to develop their muscles, but not to over-fatigue them; to fill their bellies before asking hard work of them; to quicken their nervous energy, while taking care not to exhaust it; and to raise their moral tone by every means, while everything should be done to depress that of the enemy. * * * The good officer will be measured by his power to keep his men in good heart and strength as long as possible."

"*The proper study of mankind is man,*" says Pope; and the man he means is, for us, the SOLDIER MAN.

THE KNAPSACK.

By CAPTAIN WILLIAM QUINTON, 7th U. S. Infantry.

IN the desire to lighten the burden of the infantry soldier and give him greater freedom and increased mobility it has often occurred to me that, instead of inventing machines to be placed *against* his back and *upon* his shoulders and hips, why do not these gentlemen of inventive genius confine their attention to devising some system whereby all the inventions and appliances now undergoing trial may be dispensed with altogether. Whether the weight carried rests upon the shoulders, against the small of the back, or is borne upon the hips, the glaring fact remains that the dead weight is still there and must be lifted every time that the infantry soldier raises his foot to take a step. The first question that presents itself then is in regard to the minimum allowance of articles absolutely necessary for the soldier to carry upon his person. Then, second, the mode and manner in which these indispensables shall be conveyed.

Let us then take the first question that presents itself and consider it carefully. It is as to the necessity of a great many articles now carried *by order*—for which I claim the soldier has no real use, and which he would throw away, if he were ordered upon active service, within the first five miles of travel. The articles referred to are summarized below. In addition to those enumerated there are some other articles specified in orders emanating from different regimental headquarters; but the orders referred to, all alike, tend to increase the burden instead of reducing the weights to be carried. I only know of one merciful order regarding the wearing of knapsacks—and the order I allude to was given *sub rosa*. When the commanding officer of the regiment that I have in my mind was instructed to require his men to carry the blanket bag during field operations that were to be conducted against an imaginary enemy, he complied with the order. The blanket bag was carried, but each blanket bag so carried was stuffed with hay. They were said to have looked quite neat; the men were light-hearted, even although they appeared heavily loaded, and other troops upon the

march alluded to would like to have been served in the same manner, *i. e.*, to have had that which they called the "*hay fever*."

Do troops *absolutely need* a shelter tent? I know that I will meet opposition in the discussion of this question, but I take the ground that a shelter tent is of no use under Heaven. It will *not* turn a rain. It will not remain fixed in a storm. It is totally worthless in winter and only of questionable value in summer, as it is not really required during the pleasant months. On a mild, clear day it furnishes shade it is true, but herein lies its only value. In this connection I understand that a young officer had on exhibition (possibly before a Board) at Fort Leavenworth a knapsack and shelter tent combination that only weighed—alone and without any packing—some forty or fifty pounds. The knapsack is said to have been a lovely thing to look at; all kinds of mansard roof and modern improvements, etc.; and it is further said that it only lacked two things to make it perfect, *i. e.*, wheels to support it and some light motive power to draw or push it.

Again, do troops need—*absolutely need*—an extra pair of shoes, hair brush, whisk broom, "hold-alls," coffee bag and sugar, salt and pepper sacks? Do troops require—*absolutely require*—an extra change of underclothing upon their persons? I claim that the soldier in the field and upon the march has no more real necessity for a shelter tent (combination or otherwise), an extra change of clothing, an extra pair of shoes, a hair brush, a whisk broom, and a "hold-all" than he has for a Webster's Unabridged Dictionary; for in the wars of the future troops must march rapidly, and to accomplish this end must strip to fight. The soldier can wash his underclothing in the passing stream, and a little dust, more or less, will not injure his uniform. Dust may mar its appearance to some extent, it is true, "but what of that," if the soldier but be relieved of the care, weight and anxiety that the infliction of the whisk broom carries with it.

It is really remarkable that no officer has, as yet, thought of the desirability of issuing so common an article as a table napkin to a soldier in the field, as, while it would not only preserve his uniform at meals from possible stains, it could also be used as a pocket-handkerchief* or as a towel in emergencies that might arise.

* Pocket-handkerchiefs have not hitherto been considered a necessary part of a soldier's outfit; but the times have changed, we are becoming practical in all things,

Again, I claim that any government whose administration is so faulty that it cannot supply a pair of shoes to the soldier that will last on a march to and "endurin of" the fight consequent upon such march, had better go altogether out of the business of prosecuting war. Seriously, the fact is patent to every line officer of infantry in the army, that the infantry soldier is overburdened and weighted down to that degree that he cannot make forced marches, and this as a result of the issue of a series of orders that, I think, have not been well considered. So much for the query as to articles absolutely necessary. No reference has been made to the blanket, towel, socks and piece of soap—for these articles I assume that every one regards as indispensable.

The second query is more difficult to answer, in that it will convey a suggestion, and the suggestion, although by no means new or original with myself, will doubtless raise a storm of opposition from not only the man who invented the contrivance known as the blanket-bag, but also from the inventor of every ingenious conception calculated to make of the American soldier a beast of burden. These gentlemen—all alike—have aimed to shift the burden of weight to be carried from one part of the soldier's anatomy to another. The blanket-bag hangs limp against the small of the back, which it presses all the time. The dead weight heats the back, and, after a short period, paralyzes the muscles of the shoulders. Some suggest the transfer of this dead weight so that it will all be borne upon the shoulders. Again another, and his invention is more sensible than any which has preceded it, suggests the transfer of the load so that it will all be supported by the hips; this, by means of little sticks worn upon each side, which are attached above to the pack, and below slip into sockets which hang pendant from and are made a part of the waist belt. The only objections to the latter that I know of are—first, its

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and even the pocket-handkerchief, it appears, is to find its uses in a service sense, for the War Office authorities have sanctioned a military handkerchief being patented by Lieut.-Colonel Fulton, late of the Durham Light Infantry. On this handkerchief is printed all sorts of useful information concerning the use and construction of the Lee-Metford rifle, the alphabet used by army signallers, general rules to be observed in any position in which the soldier may find himself on a campaign, the various bugle calls, and other things. This idea is a particularly happy one, and is calculated to do much good in posting the soldier in many details of which otherwise he might be ignorant. We have no hesitation in recommending the military pocket-handkerchief to the notice of commanding officers and adjutants, as it possesses undoubted merits, and ought to form part of every soldier's kit.—*Army and Navy Gazette*, London, Nov. 12, 1892. —ED.

peculiar appearance, and, second, the further fact that it will hold so much useless stuff. Just so long as there is room in a knapsack to stow away a given number of articles, some officer will see to it that no nook or cranny is left unfilled. To sum up—whether the weight rests against the small of the back, is carried upon the shoulders, or transferred to the hips, the dead weight that has to be lifted is there all the same, and no one thing short of a number of toy balloons attached to each contrivance, when worn, will grant the soldier who has to carry it any relief from the burden. Now, if the soldier were given a canvas shooting coat with numberless large, stout, reinforced pockets—the coat to be of neutral tint—say a dead grass color—and then required to carry simply a given number of rations in a haversack, a blanket, two pairs of socks, meat ration can, tin cup, towel, soap, and such number of rounds of ammunition as might be desired, would there be any necessity for a knapsack at all? The coat could be blanket-lined for winter and plain canvas for summer. It would be at once cheap, serviceable and inconspicuous. Ordinarily it would do away with the flannel blouse during the summer months, while, for use during the winter, the soldier would draw a blanket-lined coat large enough to wear over his flannel blouse, and so do away with the present overcoat altogether, a change not to be regretted when we reflect that the overcoat alluded to furnishes no protection against biting cold weather, and does not pay for its carriage in a mild climate. The present overcoat is a delusion, and dear at any price.

MUSKETRY TRAINING, AND ITS VALUE IN WAR.

By CAPTAIN JAMES PARKER, 4TH U. S. CAVALRY.

HOW much does skill in marksmanship add to the efficiency of the soldier? It is worth while for us to consider this question. We, in this country, stand always in a state of unpreparedness for war. In case of hostilities with a powerful nation, this lack of preparation is liable to be taken advantage of. Our regular army is small; our main force will consist of hastily raised levies. These levies will be deficient in all that pertains to the education of the soldier. How much of the brief time allotted to their instruction may be devoted to obtaining a familiarity with the use of arms?

The training of the soldier for battle may, as Von Scherff, a modern authority, remarks, be divided into individual and collective instruction. The individual instruction most necessary in the case of new troops is first, *discipline;* second, a perfect familiarity with the use of the musket at ranges up to 400 yards; third, the development of individual skill in skirmishing and taking advantage of ground and cover. The collective instruction, he says, must first develop the power of moving slowly and with cohesion in close order; second, the ability to perform evolutions and to deploy; third, fire discipline; fourth, a general acquaintance with the requirements of outpost duty.

This, according to Von Scherff, is a statement of simply that training which is absolutely necessary for the instruction of the raw recruit, when time presses, to make him a capable soldier, and to develop his efficiency for combat. It does not include much that goes to form the seasoned veteran—such as practice in marching and camping, in field manœuvres, in military gymnastics, in sharpshooting at long ranges, in bayonet exercise, and in other details. It may be accepted by us as a fair statement of the training which will be required by the American volunteer infantryman to make him ready for active service in the field.

After discipline, in order of importance, Von Scherff places marksmanship. After the ability to manœuvre he places fire discipline. The Germans say they have good reasons for attaching

such importance to skill in the use of arms. The Prussians to-day are the first military nation of Europe. What are these reasons?

As far back as the days of Frederick the Great we find the Prussian infantry formidable through the destructiveness of its fire. The little nation of Prussia, insignificant in size, in resources, and in population, battled for years against France, Austria and Russia combined, and in the end beat them. It was not alone the effectiveness of their cavalry which gave the Prussians the victory; it was not alone the remarkable discipline, mobility and power of manœuvring of their infantry; it was, in a great degree, the thorough musketry training the infantry received, which enabled it when in action to shoot rapidly and accurately. No such devastating fire had been known up to those days. The Austrian infantry melted away before it, and then, when the Prussian fire had done its work, when the hosts of the enemy were demoralized and thrown into confusion, came at last the supreme moment which Frederick never failed to seize, to let loose like an avalanche those horsemen which were the terror of Europe, and of which Hamley justly says: "No army has since possessed a cavalry leader or a body of horsemen which could claim any superiority over Seidlitz and his splendid squadrons."

Passing over the period of the Napoleonic wars, when the Prussian history, opposed as they were to that man of genius whose name alone was worth a hundred battalions, was one of frequent humiliation, we come to the war of 1866—the needle-gun war—when the Prussian troops, well trained and armed with a breech-loader, won easily the victory over the badly armed Austrians. This war was almost purely an infantry fight. But even the superiority of the needle-gun over the muzzle-loader cannot wholly account for the enormous disproportion of losses suffered on either side. The Prussians were almost invariably the attacking party, and yet their killed and wounded averaged about one man to every three Austrians. There were no such proportionate results as these when the breech-loader came into play in our Civil War. Besides, the tendency for a man whose gun shoots slowly is to shoot carefully. It was the *accuracy* as well as the rapidity of the Prussian fire which brought about this remarkable result.

In the war of 1870 we find the Prussian needle-gun opposed to a better weapon with a longer range and greater rapidity of

fire, and yet the better weapon was vanquished. This war developed into a contest of skirmishes, in which the superior individual musketry training of the Germans had full play. In this war, also, the Germans were more often the attacking party. The French, on the other hand, made greater use of intrenchments than did the Austrians in 1866. This war too was a war of infantry, the cavalry being little used. That the German musketry training was greatly superior, and that they made good use of the marksman's experience that leads him to fire slowly, carefully and only at ranges where it is possible to draw a bead upon the object, is apparent from reading the history of that period. We will give a few extracts that bear upon this point:

"The defensive attitude of the Prussians showed a marked difference to that of the French in firing tactics. The French fired at long distances, inflicting loss, but not decisive loss. As the German skirmishers ran forward, the French in their excitement forgot to alter their back sights and fired over their heads—they fired hastily and expended much ammunition.

"The Germans, on the defensive, allowed the enemy to approach within 400 or 600 yards. The effect of this close fire, when once let loose, never failed."*

Again: "The French soldier was taught to fire at long ranges and thus fell into a fault, which is sure, at all times and under all circumstances, to meet its punishment. They paid no attention to those elements of a sound system of shooting—steadiness, careful practice, and an economy of ammunition. * * * The French opened their musketry fire at very long ranges, from 1000 to 1400 paces. It is true that even at this distance we had men killed and wounded, but if you look into the matter closely you will not find any case where our troops were really shaken by fire at such distances. * * * The German infantry, when on the defensive, did not open fire till the enemy was within 300 or, at the outside, 400 paces. * * * It is not *much* shooting but *good* shooting which is effective. Rapid fire is seldom necessary for more than a few minutes."†

"We were in position to the east of Garenne. In front of Haybes lay two companies of the Kronprinz Regiment, extended in a single skirmishing line. Suddenly, out of the hollow near the

* Adams: Campaign of 1870-71.

† Boguslawski's Tactical Deductions.

Bois de la Garenne, a dense infantry mass appeared, bearing down on the above-mentioned two companies at a run, firing as it ran from the rifles held horizontally at the hip. I estimated it at from 5000 to 6000 men. Presently, my battery had to cease firing at the head of the column, which broke away from the main body, and bore down on the two companies. I turned my telescope on them, and, in contrast to the dense smoke of the French, I saw only here and there puffs of smoke from our line, the whole of which was lying flat on the ground. Only the captain walked slowly up and down the line, warning his men to shoot steadily and slowly. But every shot dropped its man, and the number of advancing foes became sensibly smaller. Individuals succeeded in reaching our line only to fall at the muzzles of our rifles; and the attack so desperately carried out burnt itself out. Only a few survivors turned to run, and these were soon bowled over by our pursuing fire—in ten minutes the whole mass was destroyed. Assuming that half of the column was destroyed by artillery, yet the odds were still nearly as ten to one."*

If the account given in this last extract be true, what further proof is needed to show the vast value of individual marksmanship on the battle-field.

The truth is, the immense importance which the Germans attach to accurate shooting and to musketry practice is not generally understood even by many who have deeply sought for the causes of their extraordinary and astonishing success in war. Concerning their musketry instruction at the present time, Sir Lumley Graham, in his work "The Training of Infantry for Battle," tells us that "it is the object of the most careful attention, being everywhere conducted with extraordinary zeal and method. While it is prosecuted with the greatest activity during the summer season, care is taken not to interrupt the course for any considerable time, lest the soldier should meanwhile forget the instruction which he has received and the observations which have been made to him, so that target practice is carried on even in mid-winter." The number of ball cartridges fired is limited to 130 per man annually, but this is a large allowance when we consider the wonderful economy which prevails in the German army and makes that host of men so light a burden to the comparatively small German nation. And not one of these cartridges is wasted; before one is fired, the German soldier has been so-

* Hohenlohe: Letters on Infantry.

thoroughly drilled and schooled in aiming drills, position drills, gallery practice, firing with blank cartridges, estimating distances, etc., that when the momentous day arrives for range practice he feels sure of being able to hit the bull's-eye even though it be 500 yards away! The instruction in range firing, skirmish firing and collective firing is conducted with the same patient zeal and thoroughness, and the results obtained in classification and figure of merit are remarkable, considering the limited ammunition. Speaking of these results Sir Lumley remarks: "It is very certain that the training thus given to soldiers and the skill arising from it will produce a great effect in battle." And he quotes Napoleon's celebrated saying: "*Fire* is everything—the rest is of small account."

But it is not only from the Germans that we learn the lesson of the value of marksmanship in war. This element of success or failure in war has ever been lost sight of and underestimated by students of the military art. But it is strange that we, of all peoples, should have shared in this misconception, for it is probable that our independence as a nation is to-day due largely to the fact that our forefathers were skilled in the use of the *rifle*. The inhabitants of the United States in 1776 were scattered about in a thinly settled, wild and savage country, where the abundance of game as well as the predatory habits of the aborigines made it both profitable and necessary to be a good shot. The Americans of those days, therefore, despised an inaccurate weapon, and armed themselves with the rifle, a gun which took two or three times as long to load as the musket, but which had much greater range and greater accuracy. So long did it take to load that the Hessians wrote home to their friends, sneering at enemies who took a "quarter of an hour to load and discharge their pieces." But it was not long before they had occasion to repent their ignorance, for some of the first victories of the Americans here were in conflict with these same scoffing Hessians. At Bennington the Green Mountain boys, semi-outlaws, who held the land on which they were squatters by force of arms, who lived in what was then little better than a wilderness, defeated in pitched battle these redoubtable European troops, killed, wounded and captured nearly all of them, and drove the miserable remnant in terror from the country they had dared to invade. This they accomplished with a motley force very little superior in numbers. This was a sad awakening for the officer who had presumed to criticise the

American rifle. And, note here, that this was not the only surprise for the old veterans of Europe. The Americans introduced then also a new style of tactics, one suited to an accurate shot and an accurate weapon, the line of skirmishers—the skirmish order, the order of battle of the future. We are told by some writers on the military art that the skirmish order was introduced at the period of the French Revolution, but they are mistaken; it was an American idea, one of independence and individuality, one which *we* gave to the world, with others that have shaken governments and thrones.

The successes of the Americans in this war, which finally achieved their independence, were greatly due to their ability and their enemy's inability, to shoot straight. Capt. Chester, U. S. Army, in his article, entitled "Modern Bobadilism or a marksman's method of defeating an army," an article, by the way, that in its views antedates the rifle, contends that marksmanship is all wrong, and that what is wanted is men so disciplined that they will stand in ranks two deep and, "at the word of command, turn a stream of bullets in a horizontal direction normal to the front." It was exactly such troops that the Americans encountered. The stream of bullets fortunately went over the Americans' heads and the battle of Bennington was won. This battle so weakened Burgoyne that he was forced to surrender at Saratoga, which produced the French Alliance and resulted eventually in our independence.

Such were the American marksmen, the American skirmishers. They had an American backwoodsman at their head,—Washington,—who years before when Braddock met his defeat and death had been a witness and a victim of the pedantry, the inadequacy, the weakness of the style of fighting that Capt. Chester commends.

At Boston, we are told, "the American troops knew little of discipline. Almost all were familiar with the use of fire-arms in hunting and fowling. Many had served in frontier camps against the French and Indians, but none were acquainted with military science or the discipline of European armies." These raw provincials, though not greatly superior in force, cooped up in the city of Boston ten thousand of the king's best veteran troops; and when at Bunker Hill they were attacked they withstood three separate assaults, waiting with the calmness of men who knew the power of their rifles and trusted them, until they could

draw a bead on the enemy at 40 paces. In this attack the British lost 1054 men. The result of that fight was the evacuation of Boston.

The battle of King's Mountain was another victory for the American skirmishers and the American marksmen. The British General Ferguson with 1100 men was engaged in 1780 in overrunning the province of North Carolina when he unluckily happened to invade the country of the mountain men and frontiersmen on the borders of Kentucky and Tennessee. He had struck a regular hornet's nest. These rough trappers and hunters, always banded together for defense against the Indians and always ready for service at a moment's notice, swarmed out of their mountain fastnesses with alacrity, in number about 900. They found Ferguson posted on King's Mountain and at once attacked. We read: "The fighting directions were in frontier style. When once in action every one must act for himself. The men were not to wait for word of command but to take good aim and fire as fast as possible. When they could no longer hold their ground they were to get behind trees or retreat a little and return to the fight, but never to go quite off." The attack was made in three parties, each on a different side of the mountain. The rifle soon accomplished its deadly work. Three hundred of the British were killed and wounded and 800 taken prisoners. The Americans lost but 20 killed besides some wounded. The result of the fight was the evacuation of North Carolina by the British.

Numerous other instances during the Revolution could be cited to establish the fact that highly disciplined and veteran troops who cannot shoot straight may fail ignominiously when opposed to men who may be otherwise without training, but who are skillful in the use of their fire-arms.

Turning to the War of 1812 we find a still more notable instance of the value of the American sharpshooter. In New Orleans on Jan. 8, 1814, General Jackson, with six thousand hastily collected troops, four thousand of whom were riflemen from Kentucky and Tennessee, defeated twelve thousand veteran troops led by Packenham and fresh from a career of victory in the Spanish Peninsula. Despising their untrained enemies, the British rashly charged upon our works and were flung back with a loss of twenty-five hundred dead and wounded, while the American loss numbered only 20. When we compare this

battle with that of Tel-el-Kebir, to which it had a remarkable semblance (to be mentioned later on) can we be blamed for regarding skill with the rifle as an enormous advantage on the battle-field?

The Mexican War, an extraordinary series of victories over untrained and uninstructed troops, is interesting in this connection by the fact that the American army was recruited mainly in the border states and in the South, where the population was and is always familiar with the accurate use of fire-arms, and where the percentage of rural population was exceptionally large. Of the whole number of volunteers raised for this war, the North furnished but 23,054, of which but 1048 came from the New England States. The South contributed 43,630, almost twice as many, and four times as many as the North in proportion to her population. From this fact it is fair to presume that at the breaking out of the War of the Rebellion the total force of men in the South trained to the use of arms by actual service in the field largely outnumbered that of the North.

Nor was this the only advantage in this respect that the South had over the North in 1861. The South is and always was a preëminently rural community, living with a comparatively small population in a vast area of country where game was always tolerably abundant. There is no better school of musketry than hunting. It teaches the quick, accurate aim and the presence of mind necessary on the skirmish line. It might be said that the whole white population of the South was familiar with the use of fire-arms. In fact it was necessary that they should be, for while the negro slaves they held in bondage were generally submissive, they were rightly regarded as a dangerous element which might at any moment rise in insurrection and have to be put down with force.

None of these conditions obtained in the New England States, or the Middle States, or as a rule in any of the states which gave the preponderance of men to the great Army of the Potomac. Game was scarce. Manufacturing, not agriculture, was the prevailing industry. The people lived in the cities. The census of 1890 shows in the Southern states an average percentage of 70 living in the country while in the Eastern and Middle States an average percentage of but 24 is shown. These proportions were much the same in 1861. The farmer's gun was rusty; the city man had none. A large proportion of the men who joined the

Army of the Potomac had never fired a gun; few had ever fired a rifle.

Can it be believed that we had the incredible folly to send such men into action without further training? Yes, it is so. There is no official or other data on this subject. Strangely enough no writer seems to have alluded to this extraordinary fact. What we say, we have learned by word of mouth from those who served in that war.

We have talked to many and we have yet to hear of any organization which had any preliminary training in shooting either at a target or at any other object. Our troops were *drilled* assiduously. Their training in every other way was good. Their discipline, born of patriotism and common sense, was good. That the soldier should be able to perform the manual of arms with precision was thought most necessary. But that the rifleman should be able to *use* his implement was thought unimportant. Even McClellan, the "great organizer," organized everything but musketry training. He trained his armies to stand up like men and be slaughtered without flinching. They were trained to die, but not to kill.

And so that gallant, glorious Army of the Potomac went on and on to a never failing, never ending series of bloody attacks, of bloody defeats. It was a war of skirmishers. We fought in the woods. Cover, marksmanship, quick aim, the selection of a mark, confidence in one's ability to use the rifle, meant everything. The Confederates had it. The Yankees did not have it. And so they were slaughtered. To take their places fresh conscripts came who also fought their first battle without ever having fired a shot from a gun. Many men in their inexperience loaded their pieces improperly—the bullet down—and in the heat of action went on loading and pulling trigger without being aware that their pieces were not discharged. Among 24,000 loaded muskets picked up at Gettysburg, one-fourth only were properly loaded. Twelve thousand contained each a double charge, and six thousand each from three to ten charges. In some were as many as 23 charges. It was lack of familiarity with their arms that caused this. The man who has loaded often, loads mechanically; and the man who is used to shooting would notice at once the lack of recoil.

That the Union losses in almost every battle of the Army of the Potomac were vastly greater than those of the Confederates,

is, it is believed, beyond doubt. If her losses had been even relatively great the South could not have maintained the struggle. The numbers of killed and wounded have been always magnified by Northern writers. Accurate statistics on this point are unobtainable.

In singular contrast to the lack of success of the Army of the Potomac were the repeated victories of the Northern armies in the West. The armies of the West, like those of the South, were recruited from a rural population familiar with the use of fire-arms, and over which, in that respect, the men of the South possessed no advantage. In the Western armies, as in the Army of the Potomac, musketry training was almost totally neglected. Nevertheless, such was the proportion of soldiers who before enlisting had become familiar with the use of the rifle, that from the beginning the North began to win victories in the West. Donelson was a victory; Shiloh, though a surprise, was yet not a defeat; Stone's River, Chattanooga, the battles of the Vicksburg campaign, the battles of the Atlanta campaign, Franklin and Nashville, were triumphs in which was attested the fact that in musketry training the Western soldier was fully a match for his Southern foe. Few really great defeats were suffered by the armies in the West. But how often were the armies of the East, superior as they usually were in numbers to the enemy, hurled back with terrible slaughter! What a list of fearful repulses! Read the list: Bull Run, the Peninsular Campaign, Manassas, Harper's Ferry, Fredericksburg, Chancellorsville, The Wilderness, Spottsylvania, Cold Harbor, Petersburg—catastrophe heaped on catastrophe. In reading the history of that war and of the constant defeats suffered by the Army of the Potomac, the ordinary reader, finding no good reason for the never ending failures of that splendid body of troops, magnificent in personnel and equipment, is inclined to be superstitious, and to believe that we did not win until after four years of devastation because it was not intended by some higher power that we should. But I contend that it was *not* a miracle—our soldiers failed because they were not properly trained—the workman did not know how to use his tools.

This neglect of musketry instruction continued until long after the war and resulted in many defeats suffered by detachments of the regular army at the hands of savages in Indian warfare. Many complaints, to justify our want of success, were made that the Indian was better armed than we. As a matter of fact

after we had received the Springfield breech-loader we were armed with probably the best military rifle in the world. It was acknowledged that the Indian was a better shot. And that was the real reason. The Indian shot well because he shot to kill. Ammunition was scarce with him. He would pay if necessary ten times its value for a cartridge. But every cartridge represented to him a human life. As a rule he did his killing at short range. He had little or no knowledge of the graduations on the rear sight. He scarcely ever used it. His idea was to get up as close as possible without endangering himself and then draw a bead. He would never if possible shoot at a deer at a distance greater than 100 yards. And so he did, or tried to do, in shooting at men. And if behind cover, he aimed at a man with hardly more trepidation or excitement than he would at a deer. Such fire was deadly. Godfrey in his account of the Custer massacre published lately shows that the troops with Custer were dismounted, in position, and ready for a fight when they were attacked. They were all slaughtered. We said at the time—" they must have sold their lives dearly—they must have killed hundreds of Indians." There is nothing to prove that they killed many. The facts point the other way. Custer's men included a large proportion of recruits. They had received little or no musketry training. They did *not* sell their lives dearly.

If you want to see what men who are marksmen, but are untrained as soldiers in every other way, can do against regular troops, deficient in musketry training, look at the Transvaal War. There, on February 27, 1881, some five hundred Boers, rough farmers but good game-shots, attacked a British battalion on Majuba Mountain. The Boers were armed with muzzle-loaders—the British with Martini-Henry breech-loading rifles. After eight hours fighting the Boers drove them from the mountain with a loss in killed and wounded of 550 out of 650 men and officers. The success of these Boer sharpshooters forced the British to grant them the political rights they fought for.

If you want to see how men who are regular troops but deficient in musketry training can ingloriously fail where they are largely superior in numbers to the enemy and every other condition is in their favor, look at the battle of Tel-el-Kebir in the Egyptian War of 1882. There 24 battalions of Egyptian infantry numbering 20,000 men, with over 60 field-pieces, behind strong entrenchments, were attacked directly in front, by 13,000 British

troops. The attack took place at dawn, but it had been expected by the Egyptian troops, who were drawn up behind the parapet to receive it and who began firing on the British at a distance of 300 yards. Goodrich says: "The supply of ammunition was practically inexhaustible. At intervals of three or four yards were open boxes each containing 1000 cartridges. The fire was for the most part ill-directed and too high. It appeared to the British as though they merely rested their pieces on the parapet, loading and firing as rapidly as possible without taking aim. The fusilade was tremendous while it lasted but it could only be really effective when the attacking troops were actually on the parapet." Note that the Egyptian troops evidently wanted to carry out Capt. Chester's plan of winning a battle—namely by "pouring a stream of bullets in a horizontal direction normal to the front." But to resume: the British fired a volley at 300 yards, then rushed up to 150 yards, fired another volley, rushed up to the ditch, fired another volley and took the works. This took considerable time. In spite of this fact the British lost in killed and wounded but 450 men! Two thousand Egyptians were killed, besides their wounded.

Goodrich says: "The Egyptians displayed real courage at Tel-el-Kebir, as the desperate struggle in the trenches and their heavy loss in killed abundantly prove."

It will be seen that this battle exactly resembles the fight at New Orleans, where 12,000 British troops made a front attack on 6000 American sharpshooters and were repulsed with a loss of nearly 2500 in killed and wounded. Why did the British win so easily in this hazardous attack at Tel-el-Kebir?

Because they attacked troops who did not know how to shoot. They were well armed with Remington breech-loaders. But the Egyptian climate engenders a disease of the eye which is very prevalent. And the Egyptian troops had been instructed in everything except the proper use of their arms—of that, like our troops in 1861 they were profoundly ignorant.

Do not the examples cited prove that even the "marksman's method of winning a battle" may after all have something to commend it?

Collective instruction in musketry firing, the instruction in volley firing and the delivery at the word of command of a "horizontal stream of bullets normal to the front," as Captain Chester puts it, is as old as the hills. That is a kind of training

which in comparison is very easily attained by the soldier. It was very effective at the time when a battle was fought out by firing at masses of men at short range. The introduction of the rifle changed all that, and we must remember that the adoption of the rifle as a military arm dates from the invention of the Minié ball and is of comparatively recent date. When good shots can lie flat on the ground and pick off an enemy at 500 yards the time for standing up and firing volleys at the word of command has passed. The rifle is a most delicate, accurate, scientific instrument. To use it properly requires a course of special *individual* training. A man six feet high at a distance of 300 yards subtends an angle of barely one degree. And to be able to hit a solid line of men at that distance therefore requires considerable skill. It has been said, and I believe it *has* been true, that for every man hit in battle, one hundred and fifty pounds of lead is fired away, or say, 2400 1-oz. bullets. If that be so what a margin for improvement! Of course men will not fire on the battle-field as they do on the target range, or one-tenth as well. Let us admit that they will shoot one-fiftieth as well. Even then the man who has been well schooled on the target range, who has been taught to hold his rifle correctly, to bring his front sight quickly to bear upon an object, to pull the trigger steadily without jerking—the man who has been drilled to do these things until he does them involuntarily almost—will have a tremendous advantage over the untrained soldier. The Germans in their Kriegsspiel,—worked out as far as possible, from their actual experience in war,—estimate the fire of marksmen on the field of battle as twice as effective as that of ordinary troops, and four times as effective as that of soldiers with no previous training. If this be so, God help us in our next war if we give our volunteers then, as in 1861, no musketry training before going into battle. But we are told that the marksmen on the field of battle cannot see the opposing enemy—he is shrouded in clouds of smoke. Even if that were true the marksman would do better work than the recruit. But it is not so. There may have been battles where there was no haze and the air was so heavy the thick smoke clung to the ground, but there have been many where such was not the case, and in future there will be no such conditions, for smokeless powder will change all that. On the battle-field of the future the man who has not received the marksman's training will be as useless as a woman. The smoke,

especially of his own piece, not being in the way, he will not be led so much to fire at random or in haste. He will always have an object before him at which he may take deliberate aim. That his aim will not as a rule be deliberate, goes without saying, but that it will be much more deadly than if he were in the days of the old powder is perfectly certain.

Musketry instruction in the U. S. army is a thing of very recent date. Up to 1879 we may be said to have had none. Before that time the only chance the soldier got to try his rifle or carbine was at some posts, when he marched off guard, when instead of drawing the charge, he was allowed to discharge it at a mark. Upton's tactics allowed a certain expenditure of ammunition for target practice and some troops fired at a mark five rounds a month—others fired none. About 1878 certain competitions between American and British rifle teams, resulting in victory for the former, aroused a great deal of enthusiasm which spread through the militia, who in some States followed a course of firing laid down in a work by General Wingate, N. G. S. N. Y. In 1879 Col. Laidley, Ordnance Department, presented the army with a work on rifle firing mainly adapted from Wingate's book, prescribing a course which was ordered by the War Department to be followed. This book was defective and was superseded in 1884 by the Manual on Rifle and Carbine Firing prepared by Captain Blunt.

The army had then already taken hold of the matter in earnest—the publication monthly by the department commanders of the results in companies and regiments aroused a healthy spirit of rivalry and emulation, and ammunition was not lacking. In 1883 (the figure of merit system having been introduced) began the publication by the Adjutant-General's office of the classification and order of merit of organizations. In that year we had 4834 marksmen. In 1884 we had 849 sharpshooters and 7081 marksmen. In 1885 the proficiency in skirmishing was made to form part of the figure of merit of a company. We had in that year 1510 sharpshooters and 9247 marksmen. In 1886 we had 1350 sharpshooters and 9974 marksmen. In 1887 we had 1492 sharpshooters and 11,705 marksmen. In 1888, 1533 sharpshooters and 11,266 marksmen. In 1889 the conditions of qualifications were made much more difficult, the rifleman being judged not by his best four scores, but by the aggregate figure of his last eight scores at the different ranges, to which was added the figure

of merit he should obtain in his last four runs at the skirmishing targets. In that year we had

679 sharpshooters and 3966 marksmen.

In 1890, 1000 sharpshooters and 5094 marksmen.

In 1891, 922 sharpshooters and 4593 marksmen.

These figures represent a constant improvement in instruction and results. The slight falling off in 1891 is due to the fact that in that year the artillery did not compete. Roughly speaking, in order to become a marksman according to our present small-arms firing regulations, the soldier after a certain amount of preliminary practice must be able in 40 shots fired at 6 foot targets at each of the ranges 200, 300 and 600 yards,—160 shots in all—to make an average score of $3\frac{3}{4}$, the bull's-eye counting 5, centre 4, inner 3, and outer 2; and in 80 shots fired while manœuvring at the skirmish targets starting at a distance of 600 yards, at the double, running to within 200 yards, and then back, ten halts of 30 seconds each being made, two shots being fired at each halt, or twenty during each run, he must be able to hit the kneeling figure of a man 32 times, thus making a total score skirmishing and at known distances of 720. The sharpshooter fires in addition 40 shots at 800 yards and must make a total score of 1000. The total scores required of first, second and third-class men are less than that required of a marksman in a decreasing ratio. This is the individual instruction. The collective instruction of a troop consists first of preliminary skirmishing at a line of targets, and preliminary volley firing, followed by skirmishing for record and volley firing for record. The average percentage of hits in the record skirmishing and volley firing constitutes the collective figure of merit of the organization. The average obtained by multiplying the number of sharpshooters by 200, marksmen by 100, 1st class men by 60, 2d class men by 30, 3d class men by 10, the number of men present but not firing by 0, adding these products together and dividing by the number of men in the organization, constitutes the individual figure of merit of the organization. The figure obtained by adding the individual figure of merit and the collective figure of merit together, and dividing by two, constitutes the general figure of merit of the company battery or troop. The allowance of ammunition is about 335 shots per man, of which about one-half is expended in collective practice.

This system has accomplished its object—it has clearly pointed out the way, and displayed the reward. It has as a consequence

filled the officer and enlisted man with zeal to excel, and it has made our army an army of marksmen. It is the one thing in the course of instruction of the soldier that we do well and thoroughly. Conducted as prescribed and preceded by the proper amount of aiming and position drills, gallery practice and estimating distance drills, it is superior to any course in vogue in foreign armies. But no matter how perfect a system may be there are always grumblers to condemn it utterly, because it does not in some respects carry out their ideas. Thus one man condemns it because we do not shoot in all weathers, snow or rain, as if it were possible to instruct the recruit to advantage when the rain was beating in his eyes. By shooting in uniform weather results may be compared and competition is practicable. Another man insists that because on the battle-field we fire at the feet of our opponent, we should on the target range fire at the feet of a silhouette and condemns the bull's-eye because it is in the middle, not the bottom, of the target. True, but on the battle-field we have to fire at a mark, not at an area, in order to hit anything, just as in hunting we have to fire at a bird, not at a flock; and on the range we fire at the bottom of the bull's-eye, not at the target, the rings being placed on the target to give value to shots which, striking below, would be effective by ricochets, and striking above or at the sides would hit the body of a man or his neighbor's. Another man claims that on the battle-field the shots are not marked, and that the noise and excitement there present, makes firing on the range as instruction absurd, etc., etc. These grumblers all characterize the zeal that animates the officer who with professional enthusiasm labors hard to make his company efficient, as "the target practice insanity." The peculiarity of some madmen is that they think the whole world insane. To satisfy the aspirations of our critics I would suggest that the Government erect in some favored spot a target range for their especial benefit. On this range have lines of silhouettes advancing, retreating and passaging; let smoke be puffed from scores of pipes among the figures; let several large steam-engines produce explosions and horrifying noises; and within easy range of the firing stand let there be a special machine for hurling large quantities of reasonably hard projectiles toward the firing party, such as cabbages, beets and potatoes in a partial state of decomposition to produce the necessary amount of trepidation among those to be instructed. Then during the first hard rain-storm let Cap-

tain Grumblesome take his company of recruits down to the firing point—turn on the noises, the smoke and the projectiles, commence firing and let the recruits be well and thoroughly taught how to fire when on the battle-field!

We do not deny however that the present system admits of improvement. For one thing it should be adapted to the needs of hastily raised troops. In this as in all other regulations pertaining to the army everything should be arranged with a view to application to a time of war, so that when that time comes, as it will come, suddenly, the arms, the ammunition, the equipments, the supplies, the regulations and the course of instruction shall all be ready for the incorporation into the great army of the United States of the American volunteer. For this reason the course of target practice should not be complicated or hedged about with too many restrictions, but should be made easy for the novice to comprehend. We think the present firing regulations could be greatly improved in this respect.

Second. The skirmish firing should be made the chief feature of the course, and the larger part of the time and of the allowance of ammunition should be devoted to it. It is in fact a drill in the attack of a position by lines of skirmishers, and its conditions have a certain resemblance to the actual conditions of battle which is not a feature of the firing at known distances. The skirmisher moves towards the line of silhouette targets at the double; after the signal to halt he has but 30 seconds in which to throw himself flat on the ground, and panting, his heart thumping, to estimate the distance, to elevate his sight, to load, to pick out his target, to get a good, but quick aim, to pull his trigger steadily without jerking his piece, to notice where his shot strikes, to load, and to fire again. To do all this quickly and well requires rapid judgment and lightning-like movement, and is an art that can only be properly learnt by a thorough course of training. It is true *fire discipline*.

Third. Too much ammunition is expended in volley firing. Practically the same results could be obtained with one-third the present allowance (75 rounds) if supplemented by a generous expenditure of blank cartridges.

Fourth. The man who has once shown his ability to make marksman's scores at the known ranges needs little or no further practice in that kind of shooting, and the ammunition now

wasted in teaching him what he already knows should be expended in other ways.

Fifth. All soldiers should be instructed in rapid firing both at known distances and on the skirmish range. When we see how rapidly men can be taught to fire by a little proper instruction, it seems questionable if there is any advantage in a magazine gun. For instance, during the last target season Blacksmith Kaiser of the 6th Cavalry, on one occasion while manœuvring at the skirmish targets, fired eleven shots during the halt of thirty seconds each shot being a hit on the lying-down figure, the distance being about 200 yards. By a proper drill in the manipulation of cartridges the rate of fire can be increased to an enormous extent, and the dangers of having a complicated weapon in the hands of the troops avoided.

Sixth. Recruits should be required to complete the full course of firing, instead of only a portion as at present.

In considering then, the training to be given our volunteers, to fit them for battle, it is certain that no matter how short our time for preparation may be, a good part of it must be set aside for musketry instruction. The intelligence of the American soldier enables him to master quickly the principal movements laid down in the drill regulations, and his zeal, sense of duty and patriotism, supply to a great extent the place of that discipline gained in other countries by long service. Their peculiar characteristic,—that of never knowing when they are defeated, of seldom being panic-stricken,—makes our raw troops when acting on the defensive, and when acquainted with the use of their arms, formidable antagonists, as Bunker Hill and New Orleans testify. In case of a foreign war our greatest danger would be of a sudden attack upon us before we had time to get ready, paralyzing any offensive return on our part, and encouraging those factions who after every defeat howl for peace. Our resources and population do not insure us against such attacks. For instance, although it appears to have escaped our coast defense theorizers, an active and enterprising enemy, having command of the sea and by threatening other points, could take the city of Washington amost as easily as it was done in 1814. The two or three hundred thousand men that we should raise on the breaking out of a foreign war should therefore first of all be able to defend hastily intrenched lines, and to do this they should first receive training in what they most need, the marksman's art. But some say this would take too

much time, and that the troops must be drilled. But with plenty of targets, plenty of ammunition, plenty of ranges, target practice need not interfere with their drills—the drilling and shooting can go on at the same place and at the same time. A case can be cited where a troop of 60 men went through the entire course of known distance firing and skirmish firing in nine days, over half the men being in that time qualified as marksmen. This to show what can be done, and in such a crisis trivial objections must not stand in the way—what can be done must be attempted. We have good authority for believing that with infantry, on the defensive, fire is of paramount importance, and that the fire of well-instructed troops is three or four times more deadly than that of novices. Think of an assault being delivered over open ground like that at New Orleans, Bunker Hill, Gettysburg or Tel-el-Kebir, at a line composed of sharpshooters and marksmen! Why, at 200 yards there would not be a man left to tell the tale.

But we should do more than this—we should prepare for war in time of peace. To protect our liberties the Constitution has enacted that every citizen shall have the right to bear arms. But the Government should go further and see that every citizen, available for service, shall have the opportunity to learn how to use his arms. An important part of a soldier's duty can be learned on the target range. Target practice should therefore be encouraged in every way possible and abundant prizes offered by the Government to individuals and bodies or clubs of men suited as regards physique, etc., for the military service. For these competitions and the practice previous thereto the Government should issue ammunition at cost price. It should prescribe that a military rifle be used. It should maintain target ranges in different parts of the country. It should for a small fee loan rifles to such individuals as desire to undergo the course of rifle practice laid down for the army, and issue to such citizens certificates and insignia of marksmanship. All this could be done with but little cost to the Government and under the provision of the Constitution authorizing it to provide for the Army and disciplining of the Militia.

CONCLUSION.

We have attempted in the foregoing pages to show the importance that musketry training has ever had in combat; that battles

and even wars have been decided largely by proficiency in the use of the rifle; that history teaches this lesson to Americans especially; that it is a form of military instruction particularly adapted to a country in which the principle of universal military service can never be established; that by simple and inexpensive methods a large number of our citizens, our "unorganized militia," may be familiarized with the use of the military arm and thus gain a certain value as combatants. We trust that something of this kind may be done, and when that dread crisis of a nation's history comes again,—a great battle,—when, amid the thunders of artillery and musketry and scenes of carnage the fortunes, the honor of this great republic are trembling in the balance, let us hope that we may again be able to show the world, as we did in '76, that the American Rifleman fighting in defense of his own fireside is a formidable foe, resolute in bearing, bold of action, deadly in his aim, terrible when he fires.

THE PLACE OF THE MEDICAL DEPARTMENT IN THE ARMY.

By LIEUT. J. R. WILLIAMS, 3d U. S. Artillery.

TO the discussion of a subject which has excited considerable interest of late, it is proposed to add a few facts, which have been touched upon lightly, or not at all.

More than forty years ago, the following report of a board of army officers was submitted to the Secretary of War.

WASHINGTON, November 27, 1850.

To the HON. C. M. CONRAD,

Secretary of War.

SIR:—The undersigned, officers of the Army, constituted by the President of the United States a board to consider and report upon a resolution that passed the House of Representatives July 18, 1850, touching rank and command within the Army and within the Navy, and the order of precedency between the officers of the two arms of national defense—beg leave, on so much of the resolution as relates exclusively to the Army, to offer through you, this separate report:

The parts of the resolution here to be separately considered are all of a kindred nature and four in number:

1. "The gradations of rank for the officers and non-commissioned officers of the military staff and the line of the Army."

2. "The order of succession to command among the officers and non-commissioned officers of the Army."

3. "The order of precedence between the officers of the non-military staff of the Army, and the officers of the Army having staff or lineal rank," and

4. "The extent to which officers and non-commissioned officers of the staff in the Army shall be subject to the command of officers and non-commissioned officers of the line of the Army."

It is to be regretted that all these points have not long been theoretically, or at least practically settled with us, as they had been settled a century before American Independence in the

British service—from which service Congress early borrowed all our titles and descriptions of rank, and at the same time, every *written rule* for the government of rank. But in England, as in the United States, there is no *written law*, solving, in express terms, the rights and duties, except very partially, of regimental rank, brevet rank, or staff rank towards each other; nor has the code of either country any *table* or *scale* of rank, to show the regular subordination of titles or grades. Indeed the Articles of War in the two countries [almost identical] on the subject of rank, would have been unintelligible but for the *military common law;* viz.: "the custom of war in like cases," applied as a rule of construction or explanation to those articles. This "custom" being in all cases strictly followed in the British Army, uniformity of practice therein has been the result. Not so in our service. With substantially the same Articles of War, adopted by Congress September 30, 1776, and again reënacted April 10, 1806, it cannot be denied that doubts and difficulties have, in the last thirty odd years, arisen with us on every head of rank and command now under consideration. The Resolution of the House of Representatives, before the Board, is the proof and reflection of that fact.

Whether these doubts and difficulties have arisen in consequence of slight differences of organization between our Army and that of Great Britain, or from other causes hitherto in operation among us, the Board does not feel called upon to express an opinion, but proceeds to offer such modification of the laws on this subject, as it is earnestly hoped, if adopted, may in future prevent contrariety of construction and practice.

To accomplish this important object the Board, after much reflection, submits for the approbation of the President and Congress,

SECTIONS PROPOSED FOR AN ACT OF CONGRESS.

* * *

[Signed] WINFIELD SCOTT,
TH. S. JESUP,
JOHN E. WOOL,
I. B. CRANE,
E. A. HITCHCOCK,
BENJ. F. LARNED,
T. G. MOWER.

The sections proposed for enactment by the board have been omitted, because the proposed Act never became a law.

How many of these dubious questions of 1850 have been solved by subsequent legislation? Few, if any. Presidents and Secretaries have decided some of the disputed points, and orders and regulations have been issued accordingly, but Congress has done practically nothing.

Some of the Staff Corps and Departments have attempted to settle a few of these points to suit themselves, but the Regulations of the War Department on these subjects have not been thereby materially altered, and the right of the Medical Department, or even the Adjutant-General's Department, to decide what is proper in these cases, cannot be recognized.

The Army is composed, according to the statutes, of certain classes of persons, from the general down to the professors and cadets of the Military Academy. Some of the classes belonging to the military establishment are strictly military or *militant;* some are quasi-military; and some, if we consider their characteristic duties, are not military at all. Classes like the professors at the Military Academy, the chaplains, and some others, have no duties of a military nature. Chaplains, who are now commissioned officers, have just the same duties that they had when they were civil employees of the military establishment; and the assistant surgeon, who is a commissioned officer, has essentially the same duties as the acting assistant surgeon, who is a civilian. The cure of souls hardly acquires a military character when the souls reside in military bodies, nor does the cure of military bodies differ materially from the cure of bodies not military.

The government has provided for the cure of bodies of men in the Army, a Medical Department; and for the cure of bodies of horses in the cavalry, a number of veterinary surgeons. In the former class, the surgeons are commissioned officers and have a species of military rank, and in the latter, they have no commissions and no *legally established** military rank, but aspire to both.

We have used the term "military rank;" the word "rank" itself, unqualified, is not difficult to understand. Only in the case of military rank does there seem to be any confusion of ideas. "Rank" is from the French "*rang*," and signified hardly

* In the present Army Regulations, veterinary surgeons are given the "relative rank" of sergeant-major.—A. R.—1889, par. 181.

more, primarily, than row or line. Rank and grade are often synonymous, and between the two words, judges and lawyers are scarcely warranted in drawing a hard and fast line.

Used in its ordinary sense then, "rank" is never confusing. In the English peerage, for example, are peers of several degrees of rank. A duke is of higher rank than a marquis, a marquis of higher rank than an earl. The first two *grades* were originally species of military offices, but have become simply degrees of nobility and honor.

Between different degrees of the peerage, and between peers of the same degree, it is a mere question of precedence. The Archbishop of Canterbury outranks all dukes not of the blood-royal. That is, though not a duke, he ranks *with* them, and takes precedence of most of them. Rank in the ordinary sense means then simply order of precedence.

Colonel, Captain, Lieutenant, were originally simply the titles of certain military commanders of corresponding rank or precedence. Military rank in the beginning was almost certainly the precedence attached to the different degrees of command. But, as army organization improved, and the separation between the duties of line and staff became more marked, military dignities with corresponding precedence were conferred upon certain of these military persons who only occasionally exercised the functions of command; the engineers, for instance, who rarely commanded save in sieges. In most cases, whether a degree of dignity, or degree of command, the precedency remained the same.

In the line of our Army, the question of rank is hardly separable from the question of command, either of troops, or of certain territorial units, which may be either posts, departments, or divisions. In the military or quasi-military departments of the staff; as the Engineers, Ordnance, the Quartermaster's and Subsistence Departments, the question of rank still remains associated with the idea of eligibility to command.*

There remain what were originally the civil departments of the staff, the paymasters, surgeons, and chaplains, who, performing civil duties, originally had no military rank. Gradually these

* Engineer troops are properly speaking a "special arm." Our Engineer Corps is here classed with the staff, because it is not of the line, and because, by a loose but convenient use of the word, "Staff" is made to include all that is not line.—See G. O. 51, A. G. O. 1851.

classes became commissioned officers, but without military rank proper. Then step by step, they acquired "assimilated rank," entitling them to corresponding military precedency, but not to command, nor even necessarily to military title.

There are noted in the law three different kinds of military rank, real or actual rank, (lineal rank) which confers command, or eligibility to command: brevet rank, which need not here be discussed; and assimilated rank. *

The familiar term, "assimilated rank," fits one class in the army exactly, and others by implication. It attaches to its bearer a military precedency corresponding to some grade of actual rank in the line or military staff. Thus, chaplains have the rank of captains of infantry [assimilated]. They are not captains, not even titular captains. If they are truly captains, they must be captains of infantry, a proposition which no one will maintain. Perhaps some of the officers of the Medical Department will maintain that their officers have real or actual rank and not merely assimilated rank. The law says, "Chaplains and others having assimilated rank or pay."† Who are these "others"? Evidently those who have the same kind of rank as the chaplains. Chaplains have rank without command.‡ Among those officers who have rank without command are medical officers and pay officers. The Professors of the Military Academy need not be considered in this connection, for though they are commissioned officers, they have no military rank whatever, under the law.

* The term "rank assimilated to that of the line," is used in the Regulations of 1825 to express the rank of the military staff. In the Regulations of 1841, "assimilated rank" is used to express the rank of the non-military staff, in contradistinction to the military or actual rank of the line and military staff, and such seems to be the meaning of the term to-day.

Par. 425, A. R., 1889, says, "Officers of the Navy are received with the honors due to their assimilated rank." The law, Sec. 1466, R. S., in speaking of the same kind of rank, uses the term, "relative rank."

That is, by comparison or assimilation, the Vice-Admiral ranks with the Lieutenant-General, a rear-admiral with major-general, etc. Of course naval officers have actual rank in their own service, but in comparison with the actual rank of the army, naval officers have rank with certain officers, not the rank of those officers. Relative or assimilated rank carries with it a certain honor and precedency, but does not give a right to exercise any outside command, or to assume any outside title.—(See Naval Laws, annexed.)

The foregoing does not exactly define assimilated rank, but rather clears up the idea of what is meant by this term, both in the Army and Navy.

† Sec. 1262, R. S.

‡ Sec. 1122, R. S.

The statement that "Among those officers who have rank without command are medical officers and pay officers," is not intended to deny those officers command in their own departments. The law, while not expressly conferring upon them the right to command in this case, recognizes this right by implication. In the case of paymasters, the original law concedes them the right expressly. [Act Mar. 3, 1847.] Chaplains have never been organized into a department, hence a post chaplain has no more connection with any other post chaplain than he has with a regimental chaplain, and the limitation upon the chaplain's right to command amounts to an absolute prohibition. As far as the army at large is concerned, it is evident that the rank of all three classes, surgeons, paymasters, and chaplains, is of the same sort.

And recent legislation has not changed the status of medical officers in this respect. The law which organized the Hospital Corps, and attached it to the Medical Department, did not make the medical officer a member of the "hierarchy of command," as Asst. Surgeon Macauley seems to think. (JOUR. MIL. SERV. INST., Nov., 1890, p. 1037.) The Hospital Corps is attached to the Medical Department, exactly as the hospital stewards were attached before, (Compare Secs. 1179, 1180, R. S., and Act Mar. 1, 1887.) and the restriction upon the right of command of medical officers has remained untouched. (Sec. 1169. R. S.)

The following are quotations from our different Army Regulations, bearing on the points in question. The Regulations of 1813 have practically nothing on the subject. The Regulations of 1821 are not quoted because the extracts from the Regulations of 1825 are, with one exception indicated, taken without material change from the Regulations of 1821.

REGULATIONS, 1825.

3.—It is the intention of the government that there be established in every regiment or corps, and throughout the Army, as one corps, a gradual and universal subordination or authority, which, without loss of force, shall be even, mild and paternal; and which, founded in justice and firmness, shall maintain all subordinates in the strictest observance of duty. It requires that enlisted* soldiers be treated with particular kindness and humanity; that punishments, sometimes unavoidable, be strictly con-

*Enlisted Soldiers—All persons under the rank of cadet, whether in corps of regulars, volunteers or militia drafts.

formable to martial law, and, that all in commission conduct, direct and protect, inferiors of every rank, with the care due to men from whose patriotism, valor, and obedience, they are to expect a part of their own reputation and glory.

6.—The officers of the general staff, clothed with rank assimilated to lineal rank, as those of the adjutant-general's department, and several others, will be considered, in respect to rank, on the same footing as if their rank were lineal.

7.—In other departments of the general staff, which give not rank assimilated to that of the line, as in the paymaster-general's, surgeon-general's, etc., etc., subordination shall have place in each department, according to pay proper; the higher the annual or monthly pay of any officer therein, the higher his rank in his own particular department. And all persons subject to martial law, and not *commissioned*, shall be subordinate to any commissioned officer in the service, whether the officer be, or not, clothed with lineal rank, or rank assimilated thereto.

8.—No officer of the staff, not having lineal rank, or rank assimilated thereto,* shall command any officer whatever having such rank; but on the other hand the former shall be subordinate to the latter, under the following restrictions * * *

1250.—Surgeons will have precedence in their several grades, according to dates of commissions. (They may be employed as special judge advocates, whenever it is found necessary; but will not be detailed as members of either general, regimental, or garrison courts-martial.)† In the choice of quarters, the medical staff will have precedence of subalterns, under the direction of the commanding officer, who may always claim precedence of those under his command.

GENERAL REGULATIONS FOR THE ARMY, 1835.

ARTICLE II.

2.—Staff officers without military rank, and professors and teachers of the Military Academy, are to be classed as follows; but they are not entitled to military command though they may take their places on boards and councils, according to this classification and the dates of their appointments:

The Paymaster General, The Surgeon General, The Commissary General of Purchases,	As Colonels.

* A surgeon for example.

† Sentence in parenthesis not in Regulations of 1821.

Professors of the Military Academy, Paymasters, Chaplains, Surgeons,	As Majors.
Assistant Professors and Teachers of the Military Academy, Assistant Surgeons who have served five years, Military Storekeepers,	As Captains.
Assistant Surgeons under five years, Assistant Teachers of the Military Academy,	As 1st. Lieuts.
Master of the Sword,	As 2d. Lieut.

To this rule an exception is to be made in favor of the commanding officer, who will have precedence of all who have no military rank.

ARTICLE XLIX.

6.—Surgeons and assistant surgeons may be employed as judge advocates, whenever it is found necessary; but will not be detailed as members of general, regimental, or garrison courts-martial. In the selection of quarters, surgeons will have choice with majors; assistant surgeons who shall have served five years, will have choice with captains, and those who shall have served less than five years, with first lieutenants; the commanding officer of the post or detachment, always having precedence of those under his command.

GENERAL REGULATIONS FOR THE ARMY, 1841.

5.—Staff officers of the army, and professors and teachers, and their assistants, of the Military Academy, without military rank, are not entitled to military command, though they take their places on boards and councils, according to their assimilated rank and dates of appointments; excepting that staff officers of the army, not having military rank, shall in no case be appointed, or sit as president of a mixed board or council, or exercise any military authority or command whatever over commissioned officers invested with military rank, and the senior officer of the board or council, of the latter class, will preside. But all persons subject to martial law, and not commissioned, shall be subordinate to any commissioned officer in the service, whether the latter

be clothed with military rank or not. They will be classed as follows:

1.—The Paymaster-General, The Surgeon-General, The Commissary-General of Purchases,	As Colonels.
2.—Surgeons, Paymasters, Professors of the Military Academy, Chaplain of the Military Academy,	As Majors.
3.—Assistant Surgeons who have served five years, Military Storekeepers, Teachers of the Military Academy, Chaplains in the Army,	As Captains.
4.—Assistant Surgeons under five years, Assistant Teachers of the Military Academy,	As 1st Lieuts.
5.—Master of the Sword,	As 2d Lieut.
6.—Principal Musician,	As Quartermaster-Sergeant.

6.—The commanding officer will always, whatever his rank may be, take precedence of all who have no military rank.

1217.—In the selection of quarters, surgeons will have choice with majors; assistant surgeons, who shall have served five years, will have choice with captains; and those who shall have served less than five years, with first lieutenants; the commanding officer of the post or detachment, always having precedence of those under his command.

It is evident from the foregoing quotations that the right of command of medical and other non-military staff officers in their own departments has been recognized from a very early period. Having in view this fact and the language of the Act of Feb. 11, 1847, conferring rank on the medical staff, it will be seen that the limitation on the right of command of the officers of the medical staff, gave them no *new* rights of command in their own department. In other words, the right of the Surgeon-General and senior surgeons to command their own department existed before the medical staff were invested with rank by law.

In the matter of the eligibility of medical officers for court-martial duty, it will be seen that some years before Attorney-General Berrien's opinion on that subject was delivered, the Regulations forbade the detail of medical officers as members of courts-martial, but not as members of courts of inquiry and military boards. Their liability to detail as judge advocates was announced, and they might not, according to the Regulations of 1841, preside over a mixed board or council, a restriction which was undoubtedly correct in principle, as a presiding officer exercises to some extent the functions of command. Granting that medical officers have the right to sit on courts, it is believed that it is improper at the present day for them to preside over a mixed board or court. In this connection may be cited S. O. No. 256, Div. Atlantic, 1890, where a line officer is detailed as first on a general court-martial, over an assistant surgeon his senior by a year or more:

Detail for the Court:

1.—Captain John R. Myrick, 3d Artillery,

2.—Captain Charles B. Byrne, Assistant Surgeon,

etc. etc.

The case cited by Brevet Lt.-Col. Woodhull, Surgeon, where he sat as member of a court of inquiry in 1862, does not bear at all on the abstract right of medical officers to sit on courts-martial, because the Regulations have never excluded medical officers from courts of inquiry.*

At the time when the last edition of Benét's work was published, 1866, it may be taken for granted that he stated the recognized custom of the service with regard to the non-eligibility of medical officers for court-martial duty. This custom had at various times the distinct approval of the President, as may be seen by referring to the old Regulations already quoted. Since that time, what has happened to upset this custom? An executive order or regulation? An opinion of the Attorney-General, concurred in by the President or War Department? Nothing of the sort. The best authority that can be quoted to overthow the old custom is the Digest of Opinions of the Judge-Advocate-General. The opinion to this effect which is cited in the Digest was delivered, I believe, in 1865, and is quoted at some length in Ives, p. 27.

* See for a notice of the case cited by Bvt. Lt.-Col. Woodhull, the JOUR. MIL. SER. INST., Vol. XII, p. 346.

Now it has been already stated in this paper, that "the right of the Medical Department, or even the Adjutant-General's Department, to decide what is proper in these cases, cannot be recognized." The same may be said of the Judge-Advocate-General. For many years the idea was prevalent that the opinions of the Judge-Advocate-General were authoritative, and that the Digest was therefore binding on "judge-advocates and members of military courts." Such is the statement of Professor Gardner, Judge-Advocate, in his work on courts-martial, p. 54. Most of the Department and Division commanders evidently adopted this view, hence the detail of medical officers on courts-martial became a matter of course, an every-day affair.

The Digest has been deposed, however, from its high position, and can no longer be appealed to against a well-established custom of the service.*

Captain Chester is undoubtedly in error in supposing that the detail of medical officers on courts-martial began with those who had brevets.† The statement of Surgeon Brooke,‡ and the extract from the opinion of the Judge-Advocate-General, as given in Ives, p. 27, are conclusive that the practice obtained during the war. The extract from the protest of Doctor Mower, appended to this paper, may be taken as evidence that medical officers sat in courts-martial, even before 1847. Such a practice was undoubtedly irregular at that time, and must have obtained only on garrison courts and at small posts, and have been tolerated, if known at the War Department, only on the plea of necessity. (See Simmons' opinion, quoted by Benét, p. 22, ed. of 1866.) Similar cases probably occurred between 1847 and 1861, but they can hardly be quoted as *lawful* precedents.

The Rebellion came, and with it a host of volunteer generals and officers of every grade, many of whom were totally ignorant of law, custom, and precedent. The wonder is that custom and precedent survived at all. Such cases as came before old officers of the army were probably carefully reviewed. This applies also to cases that came before the War Department, but here they were generally referred to the Judge-Advocate-General, and Judge Holt, though an able lawyer, was not a military man, and hardly an expert on customs of the service.

* See G. O. No. 3, A. G. O., 1881.

† See JOURN. MIL. SERV. INST., Sept., 1890, p. 826.

‡ See JOURN. MIL. SERV. INST., Nov., 1890, p. 1034.

But all these remarks on courts-martial are to a certain extent a digression from the main subject of this paper.

Going back to the original theme, it may be asked, what, then, did the medical staff gain by the passage of the Act of February 11, 1847? Hardly more than this: they became invested by law with a precedency which before was simply a matter of regulation, and which had been subject to change at the will of the President.*

The question of military title is not necessarily a question of rank. There has been quoted, as settling the question of military title, the following from the present Regulations,† "839. An officer shall not be addressed in orders or official communications by any other title than that of his actual rank." This paragraph is taken with but a slight change in wording, though none in meaning, from 656, A. R., 1881, which refers to G. O. 92, 1870. This order publishes a long Act of Congress, in which appears the following section, now embodied in Section 1212, Revised Statutes: "No officer shall be entitled on account of having been brevetted, to wear, while on duty, any uniform other than that of his actual rank; and no officer shall be addressed in orders or official communications by any title other than that of his actual rank."

Taken in connection with the context, none can mistake the meaning of the last clause of Sec. 1212, which is also the meaning of par. 839, A. R., 1889. Officers shall not wear the uniform of their brevet rank, nor be addressed officially by their brevet titles. Clearly then, this paragraph was not intended to cut off addressing certain officers by the name of their office. We still address our letters to the Adjutant-General, U. S. Army, not to Brig.-Gen. A. B., Adjt.-Gen'l, etc. We still address officially the head of the Engineer Corps as the Chief of Engineers, U. S. Army. We still address the Assistant-Adjutant-General, Division of the Atlantic, the Post Adjutant, and the Post Surgeon. And without contravening the regulation, we

* This view of the matter would seem to have obtained in the medical staff itself, about the time of the passage of the Act of February 11, 1847. "To give them [medical officers] a *fixed* position, which would not be subject to the *fluctuating changes of army regulations*, a legal provision was asked for and obtained."—Protest of Surgeon Thomas G. Mower, U. S. Army, against certain sections proposed for enactment by the Board of Army officers, convened by G. O. No. 28, A. G. O., September 21, 1850. A longer extract from this protest is appended.

† JOURN. MIL. SERV. INST. Mar., 1891, p. 343.

may still address Surgeon A. B., U. S. Army, using the name of his office.

Vagueness in the phraseology of certain laws has perhaps something to do with the idea that rank carries title, though in some of these laws, the meaning has never been misunderstood. Thus the original law relating to hospital stewards provided that they should have "the rank, pay, and emoluments of a sergeant of ordnance."* It was not intended to make them sergeants, least of all sergeants of ordnance, nor to call them sergeants. What was meant was that they should rank *with* sergeants of ordnance, or ordnance sergeants. Hospital stewards now rank *with* ordnance sergeants,† but this rank does not confer the title of sergeant.

So it is with commissioned officers having assimilated rank;—they rank, or have the same precedence with certain officers of the line, but they do not receive, properly speaking, the titles of those officers. An assistant surgeon of five years service has the rank of [rank with] a captain of cavalry, but his titular designation is not captain of cavalry, nor even captain. At one time in our military history, commissaries of subsistence had the rank of quartermaster and assistant quartermaster. [Sec. 11, Act July 5, 1838.] But this did not make them quartermasters, nor did they ever bear that title.

But it will be argued that officers of the military and quasi-military staff are in certain cases designated as of the rank of certain officers of the line. Is not an Assistant Adjutant-General or an Assistant Quartermaster-General really a colonel when he is said to have the rank of colonel of cavalry? Is not the Quartermaster-General really a brigadier general? The two first mentioned are certainly not colonels of *cavalry*. But it must be remembered that such officers have long been on the same footing as if their rank were lineal,‡ and have accordingly been assignable to military command. (Vide case of Gen. Jesup in the Florida War.) For many years too, a large number of officers of the military and quasi-military staff held line commissions as well as their staff commissions, and they were thus, in fact, line officers on detached service with increased rank.

*Act Aug. 16, 1856.

†Act Mar. 1, 1887. See G. O. 29, 1887.

‡Regs. 1825, par. 6.

All the officers just mentioned, having the equivalent of actual rank, have long been addressed by the title of that rank.

Certainly the practice of years was to address the officers of the quasi-civil staff, about as follows:

Paymaster DANIEL ADAMS, U. S. Army.

Surgeon JOHN VANSANT, U. S. Army.

Post Chaplain JOSHUA SWEET, U. S. Army. (G. O. 10, 1868.

The "U. S. Army" in the designations of such officers was frequently dropped.

However, even at that date, a false practice was springing up. Thus, in the same order quoted above, we read, "Major Simeon Francis, Paymaster."

Seriously, if it is proper to address a paymaster as Major A. B., Paymaster, etc., it cannot be improper to address a medical officer as Major C. D., Surgeon, etc., and a Post Chaplain as Captain E. F., Post Chaplain, etc.; nor can these officers seriously object to the style of 2d Lieutenant G. H., Teacher of Music, U. S. M. A. or to Major I. K., Chief Veterinary Surgeon, etc., designations which have been actually proposed.

To the thoughtful line officer, however, all these designations are improper. Some officers, never having known a different custom, give without scruple military title to the paymaster, while they hesitate to give it to the surgeon. Logically the reverse should obtain. The surgeon is the associate and comrade of the line officer wherever the line may be stationed; while with the paymaster, the line officer has rarely any comradeship, whatever. The paymasters are as a rule greater sticklers for the military title than the surgeons are, and the demand of the *civilian* pay officer for this title would be laughable to the line, if it were not extremely offensive.

It has been urged that army surgeons have performed duty under fire, and have volunteered for dangerous services, and in particular, that Assistant Surgeon Crawford commanded a battery in the defense of Fort Sumter. It is also true that an assistant paymaster of the Navy was with Cushing in his daring attack on the *Albemarle*, and that in the defense of Sumter there were other volunteers than Dr. Crawford; for example, a New York police sergeant, and some engineer laborers. Honor to all these men; but the greater honor to such as risked their lives without hope of reward, and upon whom the government had no possible claim for service.

The designation by which many officers of the army, and navy too, are orally addressed, is a matter of military custom and the designation often bears no possible relation to the individual's office or title. Lieutenants in the army have been addressed from time immemorial as "Mister," and this form of address is *de rigueur* in the mouths of all except enlisted men. The Naval officer puts up with the same style of address until he has reached the grade of captain, corresponding to the army grade of colonel. There is nothing derogatory in this practice, no lack of consideration or respect. It does not appear what the medical champions would call their junior assistant-surgeons. If we accept without modification the statement that "in military life the medical officer should be known by his military designation throughout its various grades," we should call the junior-assistant-surgeon, "Lieutenant."* The statement above quoted was probably intended to be taken with at least one grain of allowance, allowance for the junior-assistant-surgeon.

Why the rising generation of medical officers should object to a style of address in use from the origin of their department is not easy to understand. The writer's grandfather, a medical officer of the old Army, never objected to the style of "Doctor," and with most of the older medical officers of to-day, it is believed the question of pay is more important than the question of rank and title. That the medical officer will be in any way improved, save perhaps in his own estimation, by using the style of Colonel or Major, is difficult to believe. The demand for these titles strikes the line officer as more offensive than the refusal of them can possibly strike the medical officer. The line does not begrudge the medical staff their rapid advancement in rank and pay. Let not surgeons begrudge the line and military staff an exclusive use of titles only appropriate to military pursuits.

Lack of space will prohibit more than a brief glance at the naval laws and regulations concerning their own medical officers. It has been already implied in this paper that the "relative rank" of the naval laws is the same as the "assimilated rank" of the military laws. It is now asserted that the original laws put surgeons in the two services on the same footing with regard to rank. An examination of the naval laws and regulations appended, and a study of the history of the subject will prove this assertion. It will be observed, too, that the naval medical officer sits on courts-

*JOURN. MIL. SERV. INST., Mar., 1891, p. 342.

martial, 1st, by virtue of naval regulation (Regs. 1865, 28, 1246), and 2d, by virtue of law and regulation (R. S. Sec. 1489; Court-martial Regs., 1870, Sec. 144). Without such provisions, it is not apparent that a naval medical officer would have any place on courts-martial.

NOTES.

PROTEST.

Previous to its enactment [Act February 11, 1847] it will be recollected what was the humiliating position assigned to the officers of the Medical staff by paragraph 5, General Regulations for 1841. Under this paragraph, a medical officer of twenty years' service might be (and frequently was) required to yield precedence on courts-martial and boards, to a junior officer, perhaps a brevet lieutenant. To obviate a contingency so humiliating to the officers of the Medical Department, and to give them a *fixed* position, which would not be subject to the *fluctuating changes of Army Regulations*, a legal provision was asked for and obtained.—Extract from protest of Surgeon Thomas G. Mower, U. S. Army, against certain sections proposed for enactment by the Board of Army officers, convened by General Orders No. 28, Adjutant-General's office, September 21, 1850.

LAWS OF THE UNITED STATES.

SEC. 4. That the two "General Orders" of the Secretary of the Navy, dated August thirty-one, eighteen hundred and forty-six,* and May twenty-seven, eighteen hundred and forty-seven,† upon relative rank, shall have the force and effect of law.

[Approved, August 5, 1854.]

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*GENERAL ORDER.—Surgeons of the fleet, and surgeons of more than twelve years, will rank with commanders.

Surgeons, of less than twelve years, with lieutenants;

Passed assistant surgeons, next after lieutenants;

Assistant surgeons, not passed, next after masters;

Commanding and executive officers, of whatever grade, when on duty, will take precedence over all medical officers.

This order confers no authority to exercise military command and no additional right to quarters. GEORGE BANCROFT.

NAVY DEPARTMENT, August 31, 1846.

†GENERAL ORDER.—Pursers of more than twelve years will rank with commanders;

Pursers of less than twelve years with lieutenants;

Pursers will rank with surgeons, according to date of commission; Commanding and executive officers, of whatever grade, when on duty, will take precedence of all pursers.

This order confers no authority to exercise military command, and no additional right to quarters. J. Y. MASON.

NAVY DEPARTMENT, May 27, 1847.

SEC. 3. *And be it further enacted*, That pursers in the Navy of the United States shall hereafter be styled paymasters, and that all laws and regulations applying to them as pursers, and all responsibilities attaching to them as such, shall remain in full force, and continue to apply to them, under the title of paymasters.

[Approved, June 22, 1860.]

REVISED STATUTES.

SEC. 1466. The relative rank between officers of the Navy, whether on the active or retired list, and officers of the Army, shall be as follows, lineal rank only being considered:

The Vice-Admiral shall rank with the Lieutenant-General.
Rear-admirals with major-generals.
Commodores with brigadier-generals.
Captains with colonels.
Commanders with lieutenant-colonels.
Lieutenant-commanders with majors.
Lieutenants with captains.
Masters with first lieutenants.
Ensigns with second lieutenants.

SEC. 1468. Commanding officers of vessels of war and of naval stations shall take precedence over all officers placed under their command.

SEC. 1471. The chiefs of the Bureau of Medicine and Surgery, Provisions and clothing, Steam Engineering, and Construction and Repair shall have the relative rank of commodore while holding said position, and shall have respectively, the title of Surgeon-General, Paymaster-General, Engineer-in-Chief, and Chief Constructor.

SEC. 1485. The officers of the staff corps of the Navy shall take precedence in their several corps, and their several grades, and with officers of the line with whom they hold relative rank, according to length of service in the Navy.

SEC. 1488. The relative rank given by the provisions of this chapter to officers of the Medical, Pay, and Engineer corps shall confer no authority to exercise military command.

SEC. 1489. In processions on shore, or courts-martial, summary courts, courts of inquiry, boards of survey, and all other boards, line and staff officers shall take precedence according to rank.

DOC. NO. 148.

37TH CONGRESS — HO. OF REPS.
3D SESSION. — NAVY DEPT.

RULES AND REGULATIONS FOR THE GOVERNMENT OF THE NAVY OF THE UNITED STATES, PREPARED IN OBEDIENCE TO A RESOLUTION OF MAY 24, 1842.

CHAPTER I.

The civil officers of the navy shall have assimilated rank with the sea officers of the navy, as follows:

Surgeons, pursers, and chaplains, with lieutenants of the navy; secretaries and professors of mathematics, with masters; passed assistant surgeons, with second masters; assistant surgeons with past midshipmen; and clerks, with midshipmen. No civil officer of the navy, in consequence of any relative or assimilated rank, shall exercise any authority over a sea officer; and, on all occasions, the sea officer shall take precedence of civil officers of the same assimilated rank.

REGULATIONS FOR THE GOVERNMENT OF THE UNITED STATES NAVY. 1865.

28.—In processions on shore, on courts-martial, summary courts, courts of inquiry, boards of survey, and all other boards, line and staff officers will take precedence according to relative rank.

1246.—In detailing officers for a court-martial or court of inquiry before which a medical, pay, marine, or engineer officer is to appear, it is proper, if the exigencies and interests of the public service will permit, that one commissioned officer or more, of the same department or corps as the person to be tried, should be placed upon it; and in detailing officers for a summary court-martial, it is equally proper, under like circumstances, if a non-commissioned officer, musician, or private of the marine corps is to be brought before it, that one or more marine officers should be of the number.

ORDERS, REGULATIONS, AND INSTRUCTIONS FOR THE ADMINISTRATION OF LAW AND JUSTICE IN THE U. S. NAVY. 1870.

SEC. 18. When a non-commissioned officer, musician, or private of the marine corps, is to be tried by a summary court, it is deemed proper, if the exigencies of the service will permit, that one or more marine officers should be detailed as members of it.

SEC. 140. General courts-martial may consist of any number of commissioned officers from five to thirteen, inclusively.

SEC. 144. In detailing officers for a general court-martial for the trial of a medical, pay, marine, or engineer officer, it is deemed proper if the exigencies of the service will permit, that at least one-third of the court should be composed of officers of the same department or corps as the person to be tried.

Comment and Criticism.

The remarks under this head have, generally, been invited by the Publication Committee, which desires that, as far as practicable, these "Comments" should appear under authors' names.)

I.

"The Organization of Militia Defense."

Capt. James Chester, 3d U. S. Artillery.

I HAVE read the comments of Colonel Macpherson of Kentucky and Major Hoff of the Medical Department on "The Organization of Military Defense," with much pleasure and profit. Major Hoff indeed supplies a necessary supplement to my paper. The proper organization and equipment of the medical department of an army cannot be intelligently discussed by a line officer. For that reason I barely alluded to it in my paper.

Colonel Macpherson looks at the subject from a legal point of view and there again we find ourselves at a disadvantage. The Constitution, or the interpretations put upon it, appear to make effective national defense impossible. Now if that be true it is well to know it in time. But is it true? We dare not discuss that question. We are satisfied however that Eternal Law has established certain rights and wrongs, and if our Constitution is not in harmony therewith the sooner it is made so the better.

We are satisfied, for instance, that the defense of the State is the first duty of the citizen; that a blood-tax is indispensable to national existence. The question, therefore, is, shall that tax be paid on demand by every citizen able to pay it; or at pleasure, only by a few? The answer to that question involves the life of the nation.

In the national compact, however, the duty of the citizen is supplemented by the duty of the State. If the people pay the blood-tax promptly, the State must apply it effectively. Such a treasure should not be wasted. Now can such a trust be properly administered without preparation and machinery? Our militia is our defense. It is a complicated machine and,—some people think,—in poor working order. The head of the State has to manipulate that machine in the hour of danger. Should he be kept in utter ignorance of its parts until he is called upon to use it?

Colonel Macpherson condemns most severely a feature entirely foreign to our scheme. Our militia is State militia. It is organized, officered and drilled by the State. But when it is called into the service of the United States it reports by battalion. The battalion is a State organization. It may be used by the President as a separate battalion, or it may be combined with other battalions into larger units. These larger units are national and not State, and their commanders and staff ought to be, and were, during our last war national officers.

The argument from popular dislike needs no answer. If we abolish the blood-tax because the people dislike it, we are establishing a dangerous precedent. There are no pleasant taxes, and if all were repudiated the national compact would be dissolved. This the government can never permit.

II.

"Queries on the Cavalry Equipment."

Colonel A. K. Arnold, First Cavalry.

THE suggestions in the article by Lieutenant Cole on the Cavalry Equipment, in the November number of the JOURNAL of the MILITARY SERVICE INSTITUTION, seem to me in the main to be very good, and of great importance to regiments serving in the field.

I will only comment upon, and suggest changes on such points, as in my opinion, would greatly benefit our arm of the service.

The Carbine.—It would be a better weapon, so far as handling it on horseback is concerned, if the stock was made lighter. As it is now, the piece is somewhat awkward to handle, owing to so much bulk from grip to butt.

I believe it would be well to discard the carbine sling and present boot, substituting therefor a full length scabbard, made of leather, with straps so that it could be attached to the left side of the saddle, under the left leg,—(sabre to be carried on the right side, under the leg). One troop of the First Cavalry has been experimenting with this scabbard for the last two years, the carbine, detached from the person of the trooper, enclosed in it. This method has received the unqualified approval of all officers who have examined, or experimented with it. It preserves the carbine from injury; keeps all parts from rain and dust, and it is just as easy for the trooper, when he dismounts, to take it from the scabbard as when slung by the old method. It also gives the trooper greater confidence when mounted, and greater ability and freedom to act as a cavalryman should, either mounted or dismounted.

The Pistol.—I believe that our present long range pistol is of doubtful utility. Our cavalry, I think, should be armed with a pistol for *close work*. With the present pistol men are apt to halt and deliver fire from it at long range, thus giving an enterprising enemy a chance to take the initiative in a charge, which means defeat for the party using the pistol at a halt. Such was the experience, on several occasions, in our late war. If there is to be any long range firing mounted, the carbine should be used, and then only at such distance as would allow time to drop carbine, draw sabre or pistol, and move out so as to reach the enemy in full career. The pistol for such work should be chambered for four rounds, the calibre being about that of a 12-gauge shot gun (this would give a circumference of cylinder about equal to that of the present army size Smith & Wesson), each chamber carrying four round balls, with sufficient powder behind the balls to give them great penetration at about thirty yards. The barrel of such a weapon to be about two and one-half inches long, and smooth bore. The length of barrel and cylinder need not be over four inches, thus making a short, compact pistol, easy to handle. On the account of the reduction in number of chambers, two of these pistols could be carried; one holstered on belt, and one in holster attached to saddle. One pistol would be sufficient provided the magazine principle of loading could be applied.

The Sabre.—Thrusts would be more effective and true,—without much diminution of the force of a blow,—if the sabre was made straight bladed with a good point; and for actual work, razor edged at least eighteen inches from the point. The length of the sabre should remain as it is now, for the soldier; but for the officer, on account of foot duty, it should be three inches shorter.

The Bridle.—The one in use now is a good one. The only addition necessary to enhance its usefulness would be another pair of reins, to be used as snaffle reins. A great many of our horses, owing to improper bitting, cannot stand the heavy hand of

some of their riders when curb reins are used. They become unmanageable when quick work is required. By using the second pair of reins this can be, in a great measure, avoided.

The Bit.—With the present mode of obtaining cavalry horses, the suggestions of Lieutenant Cole, in regard to bit, would, if adopted, answer all purposes, provided slots were made through each bar, just behind the point where the mouth piece joins the bars, for the introduction of the second pair of reins.

The Saddle.—The present cavalry saddle is a good one when properly fitted to the horse's back. It is strong, light, well made, and has stood the test of rough usage for a long time, much better than any saddle as yet submitted for trial. The saddle rings and staples should be more securely fastened than now.

Field Dress.—I concur with Lieutenant Cole in all he says in regard to the proper dress for field service. I have always been an advocate for the adoption of some such wearing apparel. In the dry countries, west of the Mississippi, where a great deal of scouting has to be done, the blue flannel and kersey suits seem out of place in the field. They become receptacles for dust and dirt which no possible cleaning can eradicate. In combat, the men wearing the blue uniform become easy targets, while, with the invisible colors suggested, the chances are greatly against a hit. It is only necessary to place two men, one in the blue, and the other in the dirt colored suit, at a distance of 1000 yards, and mark the difference in delineation, to demonstrate this assertion. The one in blue is plainly visible, while the other is hardly defined ; if lying down, the one in the dirt colored dress can barely be distinguished. In battle, I believe there would be a marked difference in the percentage of hits, by far the less number in favor of the invisible suit. In these days of improved arms and progress, no sentimental ideas as to our national color should interfere with the proper colored clothing for our soldiers for actual service. For the style of coat for the field, I prefer one after the pattern of the Norfolk jacket, with such pockets as may be necessary. This jacket always looks neat, and can be made to fit comfortably without being skin tight. For mounted service, the present campaign hat is of very little account. If any wind is stirring, it is almost impossible to keep it on the head. It is made of such indifferent material, that it soon loses its stiffness, and looks very untidy. To quote from Lieutenant Cole, "It is extremely disreputable when it has been worn awhile." The adoption of the head gear described in the article, together with the dress suggested, would be a great step towards the proper clothing of the soldier for field work.

I agree with Lieutenant Cole in his remarks on our cavalry boot. From frequent trials made with leggins, on extended marches and expeditions, the leggins, worn with shoes, were far superior to boots for comfort and service. In fact, the boots on many occasions had to be discarded on account of the difficulties encountered in their use during cold and wet weather. Another very good reason for adopting the leggins is that the boots are very heavy, adding much to the weight of the trooper, so that it is impossible for him to execute the gymnastic exercises required by the new Drill Regulations. With leggins and shoes, this work is made comparatively easy under all circumstances.

In concluding these remarks, it is hoped that other officers may give their views on cavalry equipments, as the subject is well worth considering. It may in the end be a means of obtaining an equipment which is in accordance with the progress now being made in everything pertaining to military matters.

Major Theo. J. Wint, 10th U. S. Cavalry.

Most of the suggestions as to armament and horse equipments offered by Lieutenant Cole in his article entitled "Queries on Cavalry Equipment" in the JOURNAL for

November will, no doubt, meet the approval of cavalry officers. I would not recommend canvas for use under the saddle, nor the placing of the stirrup irons further forward, and have additional objections to the saddle now in use.

The saddle blanket should be of a material that will adapt itself to the shape of the back and lie flat under the bars of the saddle. Canvas, on most horses, will crease or fold under the front end of the saddle ; this is the objection to the use of jute, a much better material for the purpose than canvas. The blanket now in use is a good one.

If the stirrups were hung further forward, as suggested, there would be a constant shifting of the centre of gravity of the load according as the rider rested weight on the saddle or on the stirrups.

The saddle is probably retained in service as a matter of economy, but I doubt the economy of covering with good leather, old and poorly made saddle-trees, which do not fit the horse at the proper place and do not stay in place when put there, but instead, work forward so that the front end of the bars are over the shoulder blades and the rider several inches in front of where he should be.

Major Moses Harris, 8th U. S. Cavalry.

In the matter of the soldier's equipment conservatism should rule. It is easy to suggest changes, but all changes that have been made in the past have not been improvements. There will, however, be a general agreement among cavalry officers that there are two or three articles of the equipment the improvement of which is very desirable ; therefore it would seem the wisest course to confine discussion to these important points, lest by indiscriminate complaints and suggestions warrant may be given for the opinion that cavalry officers do not know what they want.

Lieutenant Cole very justly says that the subject of equipment is one upon which every cavalryman may have ideas of his own. I will, therefore, without apology, express myself freely with reference to the queries and suggestions of Lieutenant Cole's article.

The Lieutenant, after enumerating the merits of the cowboy's Winchester, tells us that we do not want it, but complains that our Springfield carbine is "buttressed into unwieldiness to enable the cavalryman to come to an order just like the infantry." Just what this means is not understood, but an experience in the use of this carbine embracing nearly the whole period since its issue, convinces me that no handier or more serviceable fire weapon was ever put into the hands of troops.

The buckhorn sight suggested would not stand field service even with a sight protector. The front sight of "bone or lacquer" is impracticable for the same reason. The sight recommended for the new small calibre arm by the Small Arms Board, without wind gauge, graduated in steps from 300 to 600 yards, with a leaf to turn forward or backward, will fill all the requirements of a practical military sight.

The sling of "webbing one inch wide" would become a string after a few weeks use. The present sling appears to be unobjectionable, but the swivel would be improved by General Kelton's device of a corrugated thumb-piece on the short side.

If the pistol is not to be used for charging purposes it should be as light as a due regard for effectiveness will permit. The new 38 calibre, double action, Colt's revolver, that we are promised by the Chief of Ordnance, will be an improvement upon the one now in use, and it is believed that it will inflict a sufficiently severe nervous shock at 50 yards.

The suggestion of an attachment to the pistol holster to fasten it to the saddle is a good one. It would serve to disencumber the trooper of his pistol for dismounted fighting, which will become more important with the advent of smokeless powder and the new arms.

The advantage of shortening the sabre is not seen unless the object is to get closer

to the enemy. On the same principle the trooper might be armed with a poniard instead of a sabre. The only objection known to the brass hilt is its glitter in the sunlight. The same objection applies to the polished steel of the scabbard, and the advantages of a steel hilt are not apparent. There would doubtless be an advantage in freeing the equipment of all bright objects.

There would be an undoubted advantage in a combined head-halter and bridle, but there are practical difficulties in the way, and several attempts have been made in this direction without success. The headstall of a halter that is worn constantly should fit loosely and easily. It is difficult to adjust the bit to its proper and exact place in the horse's mouth with such a headstall. As far as can be gathered from the description, the halter in a running noose around the nose and jaws would be unduly severe and liable to abuse. How does the "strong nose band, or nose piece, with a ring under the jaw" differ from the halter headstall now in use?

The safety chains for the attachment of the reins would have some advantages, but any increase of glitter and jingle is to be avoided.

The bit specified by Lieutenant Cole would not be objectionable if constructed on proper principles, though it should not be too light. In view, however, of the abominable character of our present bit, it is disheartening to observe that a cavalry officer in recommending a substitute fails to touch upon any of the important defects of the one now supplied. It should have been stated that the present bit is constructed on utterly wrong principles; that the lower branch is nearly three times as long as the upper, instead of twice its length, as it should be, thus giving an excessive and dangerous amount of leverage; that the slot through which the curb-strap passes is cut at such an angle as to render it impossible for the curb to rest in the chin groove, but is forced up across the sharp bones of the jaw, causing unnecessary pain; and that through these combined causes the application of power through the reins causes the horse to thrust his nose to the front in the endeavor to avoid the vice-like pressure upon his jaws, thus rendering all proper bitting impossible, and also rendering it impossible to drill at fast gaits and to practice the charge without disabling horses by broken jaws. It should be added that when bits constructed on proper principles are issued, they should be in different widths in order to admit of a proper adjustment to the mouths of different horses.

We are told that the saddle now in use is a good one but one of an entirely different character is recommended. The shape of the present cavalry saddle and the point of attachment of the stirrups gives a very perfect military seat; a seat that places the centre of gravity of the rider over the centre of the saddle, brings the largest possible portion of his body in contact with its surface, and causes his weight to be equally distributed. The saddle described gives that most objectionable of all seats for military purposes—the chair seat—in which the weight of the rider is placed upon the rear extremity of the saddle, it being impossible for him to rise in his stirrups without disturbing the equilibrium of both horse and rider. Such a saddle would probably be very comfortable to ride in, but is unmilitary, and could not be used without injury to the horses' backs.

The cow-boy has a professional reason for using two cinches. The trooper needs but one. Cruppers and breast-straps should be used in those exceptional cases where they are made necessary by the conformation of the horse.

Packers do sometimes put canvas next the mules' backs and as a consequence experience a great deal of inconvenience from sore backs.

Horse-covers cannot be carried on the horse without adding unduly to the weight carried by the horse.

The present saddle-bags are very objectionable in size and shape, were patterned after those carried by the horseback travellers of the borders, are unmilitary, and dis-

tress the horse by pounding on his flanks when a faster gait than a walk is taken. The canvas bags recommended would not be an improvement. They should be replaced by a small valise and two side pockets, all of leather, fitting close to the saddle.

The suggestions concerning the curry-comb are good. The present implement is unnecessarily harsh in its action.

Sharp shoeing is unnecessary. The proper remedy for slipping is to keep the frog on the ground, that it may perform the functions for which nature intended it. This may be done by the use of the Corcoran shoe; or, if prejudice is too strong, a steel shoe one-eighth of an inch thick can be used.

Whatever may be said in favor of a dirt colored uniform, I think most cavalry officers will agree that we do not want another variety of uniform.

The campaign hat, though serviceable, is unmilitary in appearance, and it is believed that a canvas helmet might be preferable.

The boot deserves all the abuse that can be bestowed upon it. It has absolutely nothing to recommend it. A well-made leather legging would have many claims to favor, but I should personally prefer a well-made boot, after the pattern of the Thompson hunting boot.

The method of attachment of the present spur is very objectionable, as the tight strap impedes circulation. The one suggested would be an improvement.

The officers' spurs furnished by the Ordnance Department appear to be of good quality, and the price reasonable.

It seems probable that the surgeons may have some objections of a sanitary nature to offer with reference to the sleeping bag.

The pinola and pinoche ration was once tried by a cavalry officer in Arizona in "the days of the Empire," but the success met with was not favorable to further experiment in the same direction.

It is calculated to make one feel very old to read of Sibley tents having been used in the campaigns of the Rebellion. Writing of the march to the sea, General Sherman says in his Memoirs, volume second, page 178, first edition: "We had no tents, only the flies, with which we nightly made bivouacs with the assistance of the abundant pine-boughs, which made excellent shelter, as well as beds."

Captain Charles E. Nordstrom, 10th Cavalry.

Lieut. Cole's article, "Queries on the Cavalry Equipment" published in the JOURNAL for November, points to the gratifying conclusion, that cavalry officers are gradually realizing that the equipment of the trooper and the horse are susceptible of improvement.

The subject intimately concerns every officer in the cavalry, and those of us who are at all able to string sentences together (the lyceum has given us a little practice in this direction; and there's more coming), should lose no opportunity to impress upon the authorities the necessity for change.

In this spirit we propose to discuss some of the suggestions and recommendations offered by Lieut. Cole, thereby adding our mite to that "Agitation and Education," without which no reform has ever yet been wrenched from conservatism.

The saddle.—The majority of officers will, it is thought, hardly agree with Lieut. Cole in his suggestions concerning the saddle. It is presumed that the cut he has given us (p. 1081), is designed to represent the tree after having been subjected to the "cutting down process" recommended; but while it must be confessed that this would give us a neater, more stylish saddle, it is feared that appearance would be realized at the expense of the strength of the tree. Weakness was the distinguishing fault of the "Whitman"; we never saw one that did not split at the pommel.

The proposition to "set the stirrup irons further forward," is hardly abreast of the most advanced opinion on the true position of the legs. Equable distribution of the pack, which includes the rider, considered in connection with "the middle of the horse's back," is one of the problems cavalry officers should set themselves to solve. The vicious system which puts everything behind the rider, and scarcely anything in front of him, has been perpetuated in the new Drill Regulations.* The foremost authority on this matter has said: "One of the great difficulties is about the pack. There is no use putting the saddle in the middle of the horse's back, and the *stirrups and rider in the middle of the saddle* [the italics are mine, C. E. N.] unless you at the same time distribute the weight of the pack equally before and behind the latter; the component parts of the dead weight must be accurately balanced against each other."† The further forward the stirrup irons are put, the further back the rider will sit; and the weight on the cantle, which needs decreasing, will be increased.

Lieut. Cole states (p. 1080), "The double cinch would insure the saddle's staying where originally placed. Capt. Scott tells me that during last winter's campaign, he rode with a double cinch loosely adjusted. His saddle once in place, needed no further attention." If the saddle *must* be kept in place by the agency of girths, we have no doubt that two are better than one, and it is barely possible—though hardly probable—that the double cinch may under all circumstances prove sufficient for the officer; but it should be remembered that the trooper rides under totally different conditions, the officer's horse, as a rule, carrying the officer only, while the trooper's is weighted with eighty-eight pounds of pack, exclusive of extra ammunition and rations. The advocates of the double cinch have, apparently, overlooked the true province of the girth. They would also seem to have forgotten that the horse is a creature of flesh and blood—that he has a stomach; that he has a heart; and above all, that he has lungs which, in order to enable him to perform his work with the least amount of distress, must have the greatest possible space for expansion. How is this necessary space to be maintained if the stomach, pressed forward by a tight girth, usurps a portion of it?

In the *Cavalry Journal* for June‡ the writer endeavored to show the evils of tight girthing and as what was said there, would seem to be germane here, he quotes:

"Having ascertained the proper place for the saddle, our next task is to inquire what means are at our command to keep it there, and if these are inadequate, to point out what additional means are required to accomplish the desired end. The saddle in place is acted upon by four different forces, or rather, by force acting in four different directions, viz.: two longitudinally, from front to rear and from rear to front, and two laterally, from right to left and from left to right. Bearing in mind that the saddle is composed of two pieces of inflexible wood, bound together by still more inflexible iron; that its under surface is fashioned in a convex shape to accurately fit a concave shape, and that unless these accurate relations between the two are constantly maintained, sore back is bound to result; it would seem reasonable to suppose that the adjuncts of correct saddling would include agents designed to neutralize the effect of any force calculated to upset these essential relations, but the fact is, our equipment embraces nothing of the kind, being limited solely to the girth, which, unless it be drawn so tightly as seriously to impede respiration, acts only laterally, and the longitudinal force is left practically untrammeled, to wander at will over the back, to make holes in it. The girth has one legitimate office, and only one,—that of preventing the saddle from turn-

* Forty-one pounds on the cantle; a little more than six pounds on the pommel.

† "Seats and Saddles—Bits and Bitting," p. 102.

‡ "The Troop in the Field—Equipment." *Cavalry Journal*, June, 1892, pp. 142-144.

ing,—and the moment we invest it with other functions, trouble infallibly ensues. If the horse were a cylinder, and if our scouting were done on level ground, then the friction of the girth would be ample to keep the saddle in place, as there would be no longitudinal motion to overcome; but unfortunately for the wisdom that has deprived us of nearly everything needed to a proper adjustment of the saddle, the horse is not built this way, but on the order of curves, and irregular curves at that, and a good deal of his work comprehends climbing up and stumbling down mountains, where nearly all the motion of the saddle is in a longitudinal direction.

"Where the horse has what is termed a 'good barrel,' the girth, if drawn *very tightly*, may keep the saddle approximately in place for a short time; but tight girthing prevents the expansion of the lungs, limits the operation of breathing, and cannot but be painful and injurious. 'Good barrels,' too, are things decidedly evanescent. Under the conditions of field service, they have a disagreeable habit of disappearing, when the form of the horse, losing that sleek, unctuous rotundity, so dear to the eye of the 'tight girther,' assumes more or less the proportions of the grey-hound. When this stage is reached—and it is not long in coming—the back, as well as the belly, shrinks, the rear ribs assert themselves and become prominent, the girth, having nothing to stop it, slips to the rear, carrying the saddle with it, two convex surfaces come together, and as the one *can't* yield the other *must*, and what do we have? Holes in the back, of course; and the tighter the girth the bigger the holes.

"Again, many horses have 'barrels' so large that the girth is found in front of the 'swell,' and no matter how tightly it may be drawn it gradually slips toward the fore legs, taking the saddle along with it, in which case we have bruised, perhaps fistulous withers, the ultimate result in the majority of instances being 'I. C.'

"There is but one remedy for this state of things:—the reinstatement of the breast strap and the crupper, which are complemental of each other, the one preventing the saddle from slipping to the rear, the other hindering it from going to the front. In other words, their use will effectually and completely serve to keep the saddle where it ought to be; all necessity of resaddling on the road will be obviated, and the girth, instead of cutting the horse in two, will be left to the performance of its legitimate and only function—preventing the saddle from turning."

Lieut. Cole's suggestions on the bit are good as far as they go; but they don't go far enough. It makes precious little difference how much money is put into the material and workmanship of a bit, if, after it is done, it proves to be constructed on wrong principles, or, which is the same thing, on no principles at all.

The proper construction of a bit involves the observance of three fundamental principles; (1) the length of the upper and lower branches, and the relation which these dimensions should bear to each other; (2) the port should afford the maximum amount of "tongue freedom," as the Germans have it; and (3) the mouth piece should be exactly as long as the mouth is wide. The branches should bear the relation of 2 to 1, the upper being 1¾ inches, the lower 3½ inches, both measured from the axis of the mouth pieces. The port should be made in two sizes, and high enough to barely clear the roof of the mouth, when the branches are perpendicular to the line of the mouth.

Let us now inquire in what particular, if any, the Shoemaker bit conforms to these principles. The mouth piece is uniform for all mouths, the sizes or numbers being determined by the height of the port; the upper branch is 2 inches in length, the lower nearly 6 inches—a proportion of 3 to 1, a tremendous leverage, to which may be referred the fractured jaws and lacerated tongues found in every troop; the port in No. 1 is so low that it gives scarcely any tongue freedom, and the curb is made of such material, and so placed, that the moment the pull commences on the reins, instead of remaining in

the "chin groove," where it belongs, and where it causes no inconvenience, it mounts up, engages the sharp angles of the jaws, inflicting exquisite pain. This is why the green horse, who has not yet received his bending lessons, carries his nose in the air—he is trying, poor brute, to get rid of the pain; and the harder he tries the more he don't get rid of it. What with the Shoemaker bit and the Goodenough shoe, the life of the cavalry horse is, indeed, a sad one to contemplate. We hear of no prospect of a change.

The *curry-comb* already has "a sole-leather back," and is thought to serve the purpose for which it *should* be used, admirably. Notwithstanding that the new drill regulations stamps with approval the barbarous practice of rasping a horse from head to croup with serrated iron, the advocates of what is thought a more enlightened use of the curry-comb, contend that, beyond removing dried mud and loosening matted hair, its main province should be to act as a cleaner to the brush, and for this purpose iron teeth would seem to be better than bristles.

Recommendations with reference to the style and weight of the shoe, are supererogatory, and will continue so "until the supply on hand shall have been exhausted."

"The horse excels in strength, speed, docility, courage, and nobleness of character," and all these excellent characteristics are devoted to the convenience and welfare of man. Among all the brute creation, he is man's best friend. Man should be grateful and undoubtedly is, but his gratitude is sometimes strangely manifested. For example: Somewhere about the fore part of the seventies, Congress made an appropriation of ten thousand dollars, to pay a gentleman, whose skill and erudition had been loudly trumpeted, for going up and down throughout the army, teaching a method of shoeing, which involved cutting away the sole until the *os pedis* was exposed, "trimming up the frog" until it assumed a "symmetrical shape," and entirely removing the bars! The seeds of this infamy had scarcely taken root when, true to the adage "misfortunes never come singly," we suffered an incursion of the Goodenough shoe, with its toe as thick again as the heel, and the heel so narrow that the seat of corn is almost entirely exposed. "The Dunbar System" has been stamped out. The Goodenough shoe still abideth with us. There were thousands of pounds of them purchased as an *experiment:* they were universally reported against; they are universally in use.

Lieut. Wm. H. Smith, Adjutant 10th U. S. Cavalry.

Lieutenant Cole evidently regards the present method of carrying the carbine as satisfactory. In this I disagree with him, and perhaps it may not be out of place in this connection to state briefly the different methods adopted by different cavalries, with the advantages and disadvantages of each including our own. The English carry the carbine in a long boot which is attached to and hangs straight down from the right side of the cantle. The advantages of this method are—that the carbine hangs entirely in rear of the man's leg so that it does not interfere with his seat or the management of his horse,—the barrel and lock mechanism are protected from the mud so that it would never be necessary to dig the mud out of the muzzle and from the front sight before the carbine could be used, as so often happens with us with our present method of carrying it. The disadvantages are, that the whole weight of the carbine is borne by one part of the saddle, and when any gait faster than a walk is taken up there is a constant pounding or succession of blows on one part of the horse's back, which has a strong tendency to make a sore,—this by the way may have something to do with the constant complaint of sore backs of which we hear so much from the English service. In addition to the above disadvantages should the trooper become unintentionally separated from his horse, as by a fall or other accident, the horse would carry off the carbine, leaving the trooper practically defenseless.

The Germans carry the carbine in a short boot which is swung from the right side of the pommel in such a way that the muzzle points to the front and downward and the stock extends back over the right thigh. This seems about as awkward a method of carrying the carbine as could well be devised and has only one advantage as far as I could see, that of not interfering with the movements of the trooper's leg in managing his horse.

The French carry the carbine slung across the trooper's back by a strap very similar to the one on our infantry rifle,—this from a theoretical point of view seems to be the best method of carrying the carbine. It combines all the advantages ;—that of being always present with the trooper without tying him to his horse when mounted as our method does ; the weight of the carbine is transmitted to the horse through the cushion of the man ; it does not interfere in the slightest with the trooper's seat or the use of his legs ; it is entirely out of the way in mounting and dismounting ; it can be readily unslung and made ready for use ; none of the parts are liable to injury by rubbing or being bent out of shape, and it is to a certain extent a protection from sabre cuts from the rear. The only question is whether or not the discomfort to the trooper is sufficiently great to counterbalance these advantages. During the summer of 1891 I spent some three weeks visiting different French garrisons, and I probably asked a score or more of French troopers and quite a number of officers if much discomfort was felt in carrying the carbine across the back, and they invariably answered "No, not after a little practice." They stated that when a recruit first began carrying his carbine at mounted drills, for a week or ten days it probably made him a little sore, but that after that time they never noticed it. It must be remembered that the French drill much more and at more rapid gaits than is customary in our service. The Russians also carry the carbine in this way. The following extract from Captain F. V. Greene's Russian Campaign in Turkey may surprise some:—"The muskets and carbines carried by mounted troops (in the Russian service) are all protected by a leather case and are always worn slung over the shoulder from left to right, the muzzle up and projecting above the left shoulder, the butt behind the right thigh ; this method of carrying the gun was adopted after competitive trials between it and the manner of hanging from a sling muzzle down in use in our service."

Our present method of carrying the carbine has all the disadvantages and none of the advantages possessed by the other methods mentioned. The carbine is very much in the way mounting and dismounting ; it ties the man to the horse, rendering it almost impossible for a man to save himself by jumping off in case his horse falls. I have known of several men being seriously hurt by having their carbine sling attached to the carbine when mounted, as contemplated by our Regulations. The weight of the carbine is all borne on one part of the saddle ; it cramps the use of the trooper's right leg deranging his seat and preventing him from using that leg, except to a very limited extent, in managing his horse : the rear sight is always getting bent and worn. I have several times seen from ten to twenty rear sights in a troop rendered unserviceable by a few months mounted drill. In muddy weather the muzzle gets clogged up with mud so that it is sometimes necessary to occupy several minutes in cleaning it out before the carbine can be fired. I remember to have examined the carbines of a troop of cavalry which had made a march of about twenty miles over a muddy road, and fully one-third of them were so clogged with mud about the muzzle that no accurate aim could have been taken, the front sights being entirely hidden ; nor could the carbines have been fired without danger of rendering them unserviceable on account of the muzzles being filled up with mud. In fact our method of carrying the carbine seems akin to our Regulation bit in that it has nothing whatever to recommend it, and it seems inexplicable that a board of experienced cavalry officers could have recommended either. As to the other method of carrying the carbine sometimes used in our

service, viz.: the "Cowboy" method under the left leg, it has all the disadvantages mentioned under the head of the English method, besides deranging the seat and interfering with the use of the leg.

As to the pistol being of doubtful utility I again take issue with Lieut. Cole. For vedettes, reconnoitring, patrols, mounted skirmishing, and wherever men have to fight singly or in small parties on horseback, I think no other weapon can take the place of the pistol. For mounted combats where as many as fifty or more men are employed I think that the sabre should be used, for the reason that in the melée resulting from the contact of bodies of cavalry of this size as many friends as foes would be killed by the use of fire-arms. As to calibre and style of pistol I agree very nearly with Lieut Cole. My idea of a cavalry pistol is to have a five-inch barrel, five chambered fifty-five calibre pistol carrying a round ball and three buckshot, with a small charge of powder. This would be an accurate and deadly weapon at any range less than 20 yards and I do not think a pistol should be used at a greater range. It has always seemed to me that our target cranks and ordnance authorities were entirely wrong in advocating a reduction in the calibre of the pistol. For rifle and carbine it is a very different matter,—it increases their accuracy, and when a man is wounded several hundreds yards distant from his enemy he is usually willing to stay there; while in close range fighting, where alone the pistol is used, a man is going to fight as long as he has any left in him and may be able to kill several men after being wounded with a small calibre bullet. I distinctly disagree with Lieut. Cole in his advocacy of the use of the carbine when mounted, as my observation has convinced myself at least, that the average man with the same amount of practice with each weapon can become several hundred per cent. more expert in the use of the pistol mounted than the carbine. I think the pistol should be carried on the person and not attached to the saddle, for the reason that it is too useful a weapon to lose in case one is unhorsed in a fight, and I should also favor attaching the pistol to the person by a lanyard. As to the sabre I would be in favor of a change in the shape of the weapon which would render it possible to keep the edge and point sharp, and I should think that a blade with a slight uniform curve and with its cross section T shaped would fulfill these conditions, as the scabbard could be so shaped that the edge of the blade would not touch it. I think the steel hilt would also be a decided improvement. As to our saddle, it is such a good one that I think we had better leave it alone. I think we are all agreed that it is a good one as it now stands, while probably very few of us would agree on any proposed changes. Lieutenant Cole says nothing about the lariat, picket pin and side lines. A great many cavalry officers think that all these articles could be dispensed with, or that a light pair of hobbles could be substituted for them. I most emphatically disagree with nearly all Lieut. Cole says in regard to our uniform. I think our undress uniform, with the exception of the boots and head dress, is, like our saddle, the very best I have ever seen. I think it would be an advantage to give the men a leggin in place of the cumbrous boot now issued and I think the head dress could be improved upon, but in exactly what way is a difficult matter to determine. I think perhaps that the head dress worn by cavalry officers at the beginning of the war combined the essentials of good looks, comfort and utility as much as any other yet invented. The objection of expense might, however, be urged against this for the men, but if our full dress were abolished, the extra cost of the hat could well be afforded by the men as well the Government. It seems strange that we should go on year after year with no attempt to get up a ration similar to the "Iron Ration" of the Germans, the Government would soon save enough from the "commutation of rations" alone to pay for quite an extensive series of experiments in this line.

Lieut. Powhatan H. Clarke, 9th U. S. Cavalry.

The opening remarks of Lieut. Cole could not be more appropriate, and it is to be hoped that the day will come when independent commissions of line officers will have the entire control over the equipment and armament of their respective branches. Let the supply departments simply attend to the purchase of the articles adopted and to seeing that the material used is the best ; we want to have clothes and weapons that we have tested and are satisfied with, and we are the best judges. Nevertheless it has been my experience that the average line officer does not put enough thought and work in experimenting on the equipment of his men and that he is at the bottom of the evil.

Lieut. Cole says that "if our men were properly mounted, our men could at least equal the feats of the Germans," etc. This is a great mistake that one sees repeated time and again; let me give my humble opinion as to what makes the German cavalry soldier what he is ; it is *work, plain, systematic*, concientious, *enthusiastic* work. Give the mounts of any German squadron to the great majority of troops that I have seen in our service, and they would not be fit for an Arizona stage line in one year. Let us abuse the Q. M. D. about the gait and shape of the horses, but their toughness and ability to stand bad riding lays over any of the comparatively delicately organized mounts of Germany, fortunately for us.

Again, Lieut. Cole says "our men are far and away better riders than the Germans" —another piece of popular fallacy. America has the best riders in the world, the best method of riding. and much of this is due to this very McClellan saddle that Lieut. Cole wants to change. But all Americans cannot ride. Not only the troopers (many of whom are by no means Americans) but many officers of cavalry cannot ride. They look on riding as work, not pleasure, and they do not care how badly nor how little of the work is done. Until these officers, either through change of taste or orders from higher authority, do get on their horses and *ride* them (not by any of these foreign methods) and first learn enough to teach their men, there is no use talking about better horses. I have never yet seen the time when instruction has been kept up to anything like the proper amount, except on the previously heralded approach of the inspector, who upon arriving often did not make even a superficial examination of the base and foundation of the soldier's education,—his horsemanship and ability to use his muscles, brain and weapons.

We see a great deal about extra duty, fatigue, etc., etc. ; this is not the hindrance. It is pretended that there is no time for drill ; this is not true. There is no post where the men cannot be got into the saddle for an hour, at least, if the commanding officer wishes it. Using the Germans again, let me say that in Germany the commanding officer of a regiment drills it ; he does not delegate his privilege. I have not in my eight years service seen the senior cavalry officer present commanding his troops, nor do I expect to see it till the department commanders order it, and order how much drill each day will be had and then come in person to inspect the result.

The trivial excuses that are made to avoid drill, especially on account of the slightest inclemency in weather, are not to our credit.

There is no excuse for this lack of training and enthusiasm in the cavalry ; our promotion is the best, we are kept more nearly to war strength and equipment. I have seen troops lying for months and months in camp with no duty to interfere with their instruction, yet not a bit did they get. The men lay in the sun and ate their meals ; the officers did little more, and yet at any time they might have been, and often were, called upon to take trails to follow which respectably required muscle, endurance and the wind of athletes. If the men had been kept at some sort of training many of the results would have been better. I have had to threaten men with my pistol to make them keep going up the trail and have had to push them along, because I could not

hold the command for them. They were unable to keep up, because they had not been kept in a decent state of muscular activity.

I hear officers who were not even in the war saying that they are too old for all this riding. I have seen some pretty old men commanding German corps, divisions and brigades,—men who had been in two wars—'66 and '70. I have seen old men ride some pretty long distances in Texas, Arizona and New Mexico, and in the parish where I lived as a boy we had old men riding between the ages of 55 and 90 years, and spirited horses at that. There are plenty of this kind of men to-day, and it would be well if some means of getting them into the cavalry were taken.

If a man rides regularly when he is young, he is not going to have any trouble in his old age. The root of the evil lies right at West Point, where the cadets, having been arranged by the Board of Professors according to scientific attainments, choose cavalry because the pay is better, or for promotion; instead of being assigned to the cavalry by the cavalry instructor or a board of cavalry officers on account of fitness for mounted service (I mean cavalry and light artillery, not the branches "mounted" on the pay rolls). Men who start their military careers with dollars and cents in their eyes are not the ones from whom we may expect any daring horsemanship or training, or any extra energetic effort for which they will not receive immediate pay. In my criticisms I do not refer to any one regiment. I have seen and served with many regiments in my time, and I have yet to serve with one to which my remarks do not apply.

To return to equipment, I believe with Lieut. Cole that the soldier can care for a much more intricate and delicate machine than this clumsy carbine of ours; let us wait however, until the new one comes out. The magazine of the French and German carbines is a simple tin clip holding four and five cartridges respectively. The German works without any trouble. A man puts in five cartridges instead of one, and shoots till the tin falls to the ground. By the way, sand is so hard on the barrels with this steel cased bullet that no reloading is allowed by the regiments, the shells being sent to the factory for reloading. I think we will have to be more careful with the new weapon. I should make five or six of these magazines the original package, substituting a belt with loops of some kind holding a full magazine in place of one cartridge; the present belt simply will not do in any way for a rapid firing carbine. I cannot see why Lieut. Cole wishes to see the new carbine longer than the present one. We want to get rid of the length and weight as much as possible. What we want is range and flatness of trajectory. The German cavalry do some target practice with their little gun which may assure us that we can get along against infantry most excellently with a barrel still shorter than at present, though it seems to me that some ingenious person could make a rear sight back of the breech mechanism.

What is said about the sights seems excellent, for I cannot believe that our sight is fit for war, nor for shooting at moving objects, at least at the shorter ranges where quick sighting is necessary.

The sling-strap as it is, is criminal. I have seen some brutal accidents due to men being held under their horses with carbine wedged in the boot and tied to the man's neck. You cannot get men to do riding that is risky thus stupidly tied to their horses. Imagine a man in a charge taking an obstacle, and the man thrown with this sling around his neck!

The carbine must be on the man, it must not be on the horse; then the man will always have it and there is no place on the saddle suitable for it. I do not like it slung over the shoulder, because men who have long distances to ride and who are expected to use their sabres and pistols quickly, will suffer from the weight on the chest. The weight should fall on the hips (not on the stomach) by a broad loose ammunition belt.

I think a gun such as the new French carbine could best be carried in a holster on the belt itself over the right hip, the stock coming back of the trooper's shoulders; at least we can experiment with the new gun when we get it. I do not see how the pistol can be of doubtful utility unless it be made too small to hurt a live man or horse, as I think is the case with our new model. I agree with Lieut. Cole in recommending a very large calibre for the pistol. I have used two gallery bullets and diminished charge in the Colt cal. 45 with excellent result at 20 paces. I don't believe in firing from a horse at any greater distance, and a pistol the chamber of which would hold three of these round cal. 45 balls would suit my idea.

I do not see what weapon could replace the pistol. How much would the average man be likely to accomplish if on a running horse firing with carbine to the rear at a pursuer? A major of the German army in the campaign of '66 was pursued by three lancers; he shot the leading one, who was directly behind him, with his revolver just in time to save himself from the thrust.

The pistol also should be attached to the man and never to the horse. Nothing but the sabre should be attached to the horse; in fact, it should never be worn by any man not on horseback. Of all methods ours is the best way of carrying it; it is easy to get out, it stays where it is put, it does not interfere with riding to any practical extent, and above all it makes no noise, at least it will not when the jingling rings are filed off and one fixed loop welded on.

The sabre is wretched in shape and material. The new Prussian model seems almost perfect, made something as Lieut. Cole suggests; but we need a board of experts in this matter. The funny thing is that the Ordnance Department does not believe in sabres, so we who are principally concerned and who will be the ones to use them, do not stand much show at improvement.

I do not completely agree with Lieut. Cole about the bridle. Our present halter is all we need, with addition of a brow-band to keep it from sliding down on the neck. The watering bit should always be worn when the horse is ridden. A good deal of experiment with many kinds of horses has convinced me that the snaffle and curb must be used together on the horse's mouth. Our halter and watering bridle are excellent; all that remains is to insert the curb bit, using the German method, their curb bridle being two simple straps as check pieces fastened to each side of the bit permanently and joined by *one* buckle on top of the horse's head, making it most simple to lower and raise the bit. It is held in place by a small strap and buckle on top of the halter. Or we can use the same method as for our watering bit. We do not need any noisy irritating chains on the reins. In a well-disciplined command it is never impracticable to dismount, unbridle and water; even when reins are constantly being wet, the leather does not crack and rot if the command keeps itself decently supplied. I have had my packers use the same reins seven months in the field, a part of the time being in the rainiest summer I have ever experienced; and let me say for our equipment which, if it does need change, is the best in this world as a whole, in this seven months only curb straps and one pair of broken stirrups gave cause for complaint. The only chain that should be about a horse is a steel curb chain with large links, such as one sees all over France and Germany; not the miserable excuses for curb chains that we see in American saddlery and harness shops. Rubber tubing or leather tubing, the chain being inserted in the tube, can be issued to men who have horses with tender jaws which become inflamed and knotted from friction of the curb chain.

Any one who has a horse whose lips have been pinched and rubbed by this curb strap of ours catching the lip on the bar of the bit, will be surprised to see how quickly this evil at least can be got rid of by using the snaffle and curb together.

Lieut. Cole's ideas on the bit seem about as practical as can be, especially the

straight curb bars and rigid ring for the reins. A bit may be made to snap into the halter as he recommends, but from personal experiences with these snaps breaking on the bits, I would advise that we make the most severe tests on any such method of attaching the bit before adopting it. We do not want any brass, neither brass chains, rosettes, brass buckles, or rivets; steel is by far the best material. Brass polishing belongs to the days of pipe-clay and parades. Horses do not like brass about their mouths; about the eyes it hurts them, causing the eyes to become inflamed; about the accoutrements it glistens and shines in the sun so that on a clear day the bridle rosette or carbine sling buckle can be seen to glisten a mile and a half away, long before the eye can discern whether the horseman be a soldier or civilian. The leather should be left tan color and all the metal cleaned but not polished.

Our bit is a caricature. I took one with my saddle to Germany, where not only the horses I had would not stand it, but I found it greeted with such smiles of polite contempt that I cut off the little brass U. S. plates and threw the bit away in a trash pile, hoping that some day when found it will be classed as a relic of the Huns rather than as an American product. I may add that our saddle was a surprise to the German officers, but it was not ridiculed by any means. They saw its good points and many of them asked for them. They were so courteous to me as an American that I requested that the courtesy of allowing some of their officers to buy a few of our regulation saddles be extended in return, but it seems the *Regulations* forbid this and I had to explain that our people were more polite than our Regulations. The hooded stirrups were objected to; they have never had anything but an iron stirrup in Europe, and the country does not make the large hooded stirrup a necessity. This large hooded stirrup is one of the best items in our equipment.

As for the saddle, I have no patience with any real modification of this splendid and almost perfect creation of the American cavalry. If any one wishes to lighten it let him take off the top cover and sand paper it gently, as a master violin maker would a celebrated instrument, and try to change the shape of the seat as little as possible. After trials of English saddles, Whitman saddles, Hungarian and Prussian saddles, I am firmly convinced that if any man objects to our saddle for *our* cavalry service, it is because he cannot ride it and would do worse on any other.

I acknowledge it takes a tougher man to sit all day in our saddle at a rattling good trot than on the Whitman or English saddle, but we have got plenty of tough men,—they are the only kind we want. But a man can stay in this saddle of ours under tougher circumstances than he can in the other, and that is a thing we have also got to remember; we want a saddle that a man can fight in, ride in, stay in. That high cantle and pommel were not made to hold coats and cans alone, they were made to hold riders also and good riders. We cannot afford to let our soldier glide off like a steeple-chase jockey or a fox-hunter at every stumble. The idea of cross-country riding is to take a decent amount of chance of not being killed when the horse goes down, and there one is willing to fall off under some circumstances when a soldier can't afford to. We must stay with our horses at all hazard. and if we go down in a charge then it is a matter of bad luck and no worse than getting killed by a bullet.

The staple, as Lieut. Cole says, should be driven in and clinched through the saddle; let me add that no screws should be used; rivets of steel in place of them, through wood and leather both.

The saddle sent me by the Ordnance Department to Germany would not cinch on any horse in the regiment, and when commanding my own troop in Arizona every new saddle had to be taken up in the same way before it could be used. Imagine our sending men with such saddles to Chili for their small horses.

The attachment for rapid cinching is one of the greatest improvements I have seen

since joining. I had one made after Lieut. Cole's suggestion. I believe the leather guard on the girth will have to extend up to the leather cincha, keeping this hook from the horse. It is safer to have it so. For my part I will have all my troopers supplied with this hook at once.

I do not believe that canvas under the saddle blanket is necessary. I would not want to put my shelter tent under my saddle blanket if I had to sleep under it many months. Good riding and daily work in post is the best preventive against sores.

Our saddle bags are ludicrous. In a good deal of scouting during a period of five years and more, I never saw the necessity for these ponderous affairs. Experiments should be instituted with the bags suggested by Lieut. Cole. A pair of small pockets slung on the pommel are all that I believe we require. A part of the saddle pocket ought to be made especially for horseshoes. One front and one hind shoe ought certainly to be all that a man should carry on his saddle in the roughest country, and generally one front is sufficient. If proper discipline exists and a troop has a good blacksmith the shoes will never come off till toward the end of a very hard march, and on most ground the hind foot can go unshod safely until camp is made. The lariat, side lines, etc., may be necessary for small bodies of cavalry operating against Indians, but in regular warfare a pair of light hobbles and a *vigilant herd guard* ought to prevent the loss or stampeding of horses. Our nosebag is too clumsy, a very light linen sack will do for all practical purposes. Lieutenant Cole's ideas about the curry-comb seem excellent.

I agree with the uniform suggested, which should be gray or brown, but not of canvas, which is too hot in summer. Against rain let the men carry a brown oil skin overcoat coming down to the stirrup and covering the saddle entirely, having a hood of the same material. For winter, and to replace the present overcoat, the coat known in the Department of Dakota as the Miles coat should be adopted. It is the most practical garment I have ever worn or seen.

The campaign hat is not so very bad, but it should be made of better material.

The shirt should be of the color of the uniform, as should all the belts, etc. Then with the brown saddle there would be few points to assist one's enemy in aiming; and it is great advantage to have bull's-eyes stuck over the vital parts of one's enemy, not only for carbine and revolver but for lance and sabre also. Riding trousers should be worn buttoned around the calf of the leg and loose enough about the knee for climbing and for being comfortable in shooting dismounted. The leggin is a necessity; no boot will do. The present boot should be worn only by those who make them, and those who force them on our men. The spur should be a long straight steel gaff, with a good sharp rowel, protected from striking the ground by being set eccentrically into an enlargement of the gaff; also steel spur chain under the shoe and a strong strap and buckle over the instep; an iron stud screwed in at the top of the heel to support the spur so that it will not have to be too tight and to allow play in descending steep inclines.

Officer's spurs are furnished by the Ordnance Department; mine were jokingly called theatre spurs in Europe. They are of no account whatever; the chains break and the spur itself gets out of all shape.

When we do get a practical American equipment it will be worn. It should be the same for officers and men; all officers will then know and feel what their men are wearing. Let the officer be distinguished by his intelligence, common sense, activity and horsemanship, which will stick out all over him, instead of by broad yellow stripes and other decorations. He may not serve for as good a target to the enemy but he will serve as a better mark for his men.

Since Lieut. Cole has started this subject so appropriately and well, let all of us assist him, until we are practically equipped for work, not show.

I would like some man to attempt to defend this full dress, white glove, parade and guard mounting system of ours. It cannot be defended, nor can this lack of instruction and shirking of military work which, coupled with a contemptuous ignorance of the advances made since '65, have almost made us distrust our much vaunted American common-sense so far as the army goes.

III.

"Guns and Forts."

Lieut. E. M. Weaver, R. Q. M. 2d U. S. Artillery.

THE article of Colonel King entitled "Guns and Forts," in the November number of the MILITARY SERVICE INSTITUTION JOURNAL, is one of special interest to the Coast Artillery. The arduous civil functions of the Engineer Corps are such that we are not favored with as many contributions to our military literature from this source as we would all like, therefore the original paper by Colonel King, and the translation by Captain Mahan of "Notes on the Field Gun of the Future," rendered this number of more marked interest to artillery officers than usual.

Passing over Colonel King's unique treatment of powder pressures and gun strength I wish, in these remarks, to refer solely to that portion of his article covered by the following statements:

"If there were no guns in the country larger than 10-inches calibre, it would still be possible to defend our harbors against any ships now afloat or likely to be launched for many years to come," p. 1070.

"No naval architect would now pretend to build a ship with armor that could keep out even medium calibres of projectiles, except in some very limited space like a turret or bulwark," p. 1071.

It thus appears that Colonel King finds, like others who have studied the question of armament, that the guns needed hinge directly upon the strength of armor.

If it be true that a 10-inch gun can perforate any side armor that may come against us, it goes without saying that this calibre is large enough. But do the statistics of the testing ground support Colonel King's claim? It is believed that they do not, and it is thought this assertion may be adequately established, for the purpose of these brief remarks, by reference to one or two well-known tests.

As far back as 1882, at Spezia, a 17.7-inch forged steel projectile was fired at a 18.9-inch Schneider all steel plate. The striking energy was 34,080 foot tons. The effect of the blow was that the plate was penetrated to a depth of 12.5-inches, the projectile was set up but did not break, rebounding entire. This plate was intended to represent the water-line armor of a standard battle-ship, and the navies of England, France, Italy, and other first-class Powers have battle-ships afloat carrying water-line belts of the standard of the plate tested, of 18-inches to above 20-inches thickness. It must be admitted that it is quite possible to have such armor as this in front of us at the present time, not covering "some very limited space" but constituting the protection of the complete water-line region—the most vital of the entire ship—besides the turret armor covering the larger naval guns.

Does Colonel King propose to abandon altogether the attack of water-line armor? If not, how much damage can 10-inch guns do to such armor?

In response to this last query, an excellent reply is had in the experiments made at Spezia in the fall of 1884. In these, four 10-inch forged steel projectiles were fired at a 18.9-inch Schneider plate from a high-power B. L. Armstrong gun, the striking

velocity being over 2000 f.s., and the striking energy over 15,000 ft. tons—the plate being practically at the muzzle of the gun. The official remarks on this test are as follows: "The rear of the target was entirely intact; the bolts uninjured and showed no signs of fatigue. The projectiles were badly broken up. * * * The plate and backing would admit of two more shots being fired." It is difficult to conceive of a more direct and complete reply than this.

Many examples could be cited tending to show that the strength indicated by the plates in the above tests was not exceptional, even so far back as nine or ten years ago. It is true that examples may be cited showing a lower standard of armor strength at this point, but it would not do to base calculations on an inferior standard, which, indeed, as Colonel King himself puts it, should "involve something of prediction."

It is not too much to assert that since 1882–84 the standard of armor strength has increased 40 per cent; that is, a 12-inch plate to-day, made of nickel steel, 0.35 per cent. carbon, and treated by the Harvey face carbonization process, is the equivalent in resisting capacity of an 18- to 20-inch plate of a decade back. The recent test of a 10½-inch Harveyized nickel steel plate at the South Bethlehem Iron Works testing ground, in which five 8-inch Holtzer steel projectiles were made to splash almost like water on the face of the plate, and with little more effect, amply supports the estimate here made of the strength of the new armor.

It is believed that Colonel King has been led to commit the error of assigning a too low value to the strength of armor.

In this connection it is proper to point out that not only have many underestimated the absolute strength of armor, as measured on the testing ground, but also, many more have failed to credit to armor the advantage it will have over the gun in actual warfare, by reason of the fact that the short range and the normal impact of the testing ground will give place to relative long range and oblique impact.

In the first part of his paper, Colonel King inveighs against large calibre guns. To such an extent does he carry his unfavorable comments, that one is at a loss to reconcile his earlier expressions with his advocacy in the closing lines of his article of a truly colossal type of gun,—24-inch to 36-inch guns, 100 feet long. His object in mounting these guns is to secure "a kinetic energy of 43,000 foot-tons, which would undoubtedly perforate the heaviest armor afloat." The guns are smooth bores so, as a matter of course, a larger calibre has to be employed than would be necessary if the oblong projectile of a rifle gun were used.

Colonel King's method of placing these guns, in low sites near the water and in fixed positions, is quite similar to that advocated by Captain Fabre of the French Artillery, who places the large guns of his "battering batteries" in just such positions, and for the same purpose as that given by Colonel King.

Our Ordnance brothers will not probably look with favor upon the large guns Colonel King proposes, and, if it ever happens that the artillery has a voice in such matters, it would, I am sure, prefer modern high power rifles of considerably smaller calibre for breaching water-line armor.

There is no question that it is foolish to advocate the making and mounting of big guns just for the sake of bigness, as Colonel King sets forth in the first part of his paper; it is not known that this has ever been done by any one. On the other hand, if it be true that the 18-inch to 20-inch water line and turret armor of battle-ships requires that we mount guns that will give from 40,000 to 50,000 foot-tons of muzzle energy, and even greater, to perforate or shatter it at fighting ranges, then it is essentially reasonable to advocate large calibre guns—"*as large as may be necessary*" *to do this particular work;* the calibre depending, of course, on the muzzle velocity and sectional density of the projectile in any case.

IV.

"Whistler's Graphic Tables of Fire."—Jump.

Capt. James Chester, 3d U. S. Artillery.

LIEUTENANT WHISTLER'S Philosophy of Jump—see JOURNAL OF THE MILITARY SERVICE INSTITUTION for November, 1892,—opens up a new and interesting subject for artillerists. So far as we know, it is the advanced guard of that army of ideas, which has been assembling in the artillery mind ever since the phenomenon became a recognized feature in gunnery. No matter whether we agree with Lieutenant Whistler or not, we must confess that he has opened the controversy in a very creditable manner. Differences of opinion are to be expected on such a nebulous phenomenon, but thorough discussion ought to clear away its nebulosity, and help us to discern the naked truth. Whoever has a theory therefore, or even a belief on the subject, ought to produce it without hesitation, however heretical it may seem to be. Discussion lives on differences of opinion. It is active and earnest opposition that brings out, with telling distinctness, the weak and strong points of any theory, and it is the discussion and not the enunciation of the theory that has the greater teaching power. The reading of a thesis may be endured with sleepy indifference, even by dissentients; but the discussion of its controvertible points arouses attention and stimulates thought in the mind of every listener. Controvertible points are always interesting and their attack and defense are always instructive. Free discussion is a capital educator. Ideas are ripened or destroyed under its influence without the knowledge, and almost against the will of the mind that conceived them. And it is this unconsciously acquired education which ripens the learning of professional men. Learning and education are by no means synonymous. The mind of a merely learned man is a kind of silo for the storage of green crops. He reaps where others sowed and gives the sun of controversy no opportunity to ripen the crop. Controversy is the great ripener. It works slowly but it works well. The argument may often be unpleasant as are the rays of the sun; but the beneficial results ultimately become recognizable. Not only do they ripen the wheat, but the tares also, and so hasten the harvest when separation becomes possible.

Prompted by these views we cast our contribution into the caldron, hoping that, if it adds no body to the broth, it may help to clarify it.

Before proceeding to the consideration of Jump as presented by Lieutenant Whistler, it will be well to take a short survey of the subject as it has officially appeared in our service. Although such a survey can disclose no new ideas perhaps, it will help to clear the ground and give us, at least in outline, the history of the subject so far as our army is concerned. The subject has been in the air of late in unmistakable quantities, and some authors have even ventured on *ex cathedra* explanations of it.

But the literature of Jump is limited. There is next to nothing about it in any of our text-books. Benton, the author of our text-book on gunnery of twenty years ago, knew nothing of it; Tidball, our latest official text writer, merely recognized its existence, as late as 1880, and there is nothing in the Ordnance Reports since that date to indicate that the technical branch of our arm has given it serious consideration. So also with the professional press. So far as our acquaintance therewith goes, the subject has been ignored, or, if incidentally alluded to, unexplained. In short we have seen no clear and satisfactory explanation of Jump anywhere. We are not forgetful of what McKinley says in his valuable text-book. His theory and arguments will be noticed later on. They are by no means new. We have met them many years ago doing duty in another cause before the phenomenon of Jump was even dreamt of.

In the meantime we must look about us for the earliest idea of its existence in our service.

That Jump existed in the days of smooth-bore guns is not to be denied, although it was unrecognized as a separate and distinct phenomenon. It was not until breech-loading rifled cannon had reached a high stage of development that the peculiar phenomenon now called Jump was first isolated and given a distinctive name.

In smooth-bore days the vagaries of a shot were very generally attributed to windage, or rather the balloting of the projectile in the bore which the existence of windage permitted. If a shot was then observed to rise in opposition to gravitation above the line of the axis of the bore, it was explained by balloting. Scientific gunners said—and said truly—that the progress of a round shot through the bore of a gun consisted of a series of bounces, the shot striking the top and bottom of the bore alternately in rapid succession, and that if the last point of contact between the shot and the gun was at the top of the bore, the progress of a point on the upper surface of the shot was momentarily checked and the shot was set revolving upwards on a horizontal axis, and so rose, in spite of gravitation, above the line of its projection. In other words, and to use the language of the billiardist, the shot was given an upward English and so acted eccentrically. In proof of this they sometimes cited the rather mysterious performances of the gyroscope. Indeed, whenever an old-time artillerist encountered any vagary in the motion of a projectile, he looked to the gyroscope for an explanation. If he was crowded in an argument he cited the gyroscope in a familiar sort of way, and as a rule that ended the matter.

Now although we have profound respect for the gyroscope, we cannot help doubting the interpretations put upon some of its performances, and we candidly confess that we breathe more freely since the discovery of Jump. That the lateral deviation of spherical projectiles was often due to rotation about a vertical axis, hardly admits of a doubt; but that rotation about a horizontal axis, in combination with a motion of translation, would raise a round shot above the line of its projection is somewhat difficult to assimilate. Still such rotation invariably accompanied increase or diminution of the range, and it was natural perhaps, before the discovery of Jump, to credit it with the phenomenon. It is unnecessary to do so now. Rotation about a horizontal axis, and the rise of the shot above the axis of the bore, need not now be considered cause and effect.

We have said that General Tidball recognized the existence of Jump in 1880, and as he was the first to do so officially in our service, it will be well to ascertain exactly to what extent he recognized it. We cannot do this better than by quoting his own words. After discussing the principal causes which produce deviation in the flight of projectiles he says on page 59 of his Manual:—"In addition to the foregoing there are other sources of error, which, although exceedingly minute nevertheless exist. Among these may be mentioned the influence of the axial rotation of the earth: *the spring of the carriage;* the dip of the muzzle; the effect of the rays of the sun in heating one side of the piece more than the opposite side, and a like effect on the projectile." The italics are ours. We have quoted this passage at length, partly to introduce, in the author's own words, the name first given to the phenomenon under discussion, but principally to show the estimation in which it was held in 1880. It was declared to be "exceedingly minute," and was classed with such insignificant causes of deviation as the rotation of the earth and the unequal action of the sun on opposite sides of the gun and the projectile.

But the persistent gun practice at the Artillery School, carefully conducted and keenly watched by competent observers, disclosed the fact that a rifle projectile, after leaving the muzzle, rises above the line of its intended projection, and as the gyroscope

refused to account for the phenomenon, "the spring of the carriage" assumed an importance hardly contemplated by General Tidball in his Manual. Experiment demonstrated that General Tidball was close to the truth upon this subject. There *was* a difference between the angle of elevation of the gun and the angle of departure of the shot, and this difference was probably due to the spring of the carriage. He erred however in his estimate of the magnitude of the difference. It is not "exceedingly minute." On the contrary, in some cases it is very large, and has no doubt helped to give a reputation for range to some guns, which ballistic science could not account for. The excellence of velocity instruments and the accuracy of ballistic science have yielded a set of formulas which give practically accurate results, and the abnormal action of any gun at once becomes the subject of scientific analysis. In this way "the spring of the carriage" was recognized as a very important phenomenon, and its magnitude for certain guns came to be approximately known. When it changed its name to Jump, I have been unable to ascertain. There can however be no doubt that General Tidball's "spring of the carriage," and the more modern "Jump" are one and the same phenomenon.

Having thus discovered the birth of the idea in our service, and traced its history and development through the early years of its existence, from a mere suspicion, "exceedingly minute," to its recognition as a fact of considerable importance, we shall now examine available evidence as to its magnitude. Unfortunately the evidence upon this point is not abundant. This is to be regretted, because without accurate information as to the magnitude of Jump for all the guns and carriages in our service, the cause and nature of the phenomenon are hard to get at. Experiments ought to be undertaken immediately, to determine finally and officially the magnitude of Jump for every gun in our system, as has been done by Lieutenant Whistler for the 8-inch Muzzle Loading Rifle. His chart is the only guide our gunners have, and as it embraces only one gun, in dealing with other guns they have to pick up information as to Jump wherever they can find it, and be satisfied with it when they get it without that official guarantee of accuracy which the importance of the data demands. In other words, they have to be guided by scraps of information picked up incidentally and accepted entirely on trust.

Captain Ingalls, to whom our gunners are so much indebted for mathematical assistance, has given some attention to Jump, and has, we believe, conducted experiments to determine its magnitude; but as the results of these experiments have never been published, they are not within the arena of discussion. We find scattered through his books on Ballistics, certain statements incidentally introduced in problems, giving the Jump of certain guns, but we have no assurance that they are the results obtained by the experiments referred to. We find, on page 6 of his Hand Book on Exterior Ballistics, the statement that Jump "varies in value from an angle too small to be appreciable, to one of a degree of arc, or even more, according to the kind of carriage and platform used." Now if we had the data upon which that statement was based, the philosophical problems involved would be easier to deal with.

At other places in his Hand Book, Captain Ingalls gives incidentally the Jump of various guns as follows:—

The 3″ M. L. Field Gun (U. S.) from	20′ to 30′
" 3.2″ B. L. Field Gun (U. S.) from	22′ to 23′
" 10″ S. B. Rodman Gun (U. S.)	10′
" 12″ B. L. Cast Iron Rifle (Experimental)	16′
" 20″ B. L. Rifle (British proposed)	6′
" 24 Cm. Krupp Gun	11′
" 40 Cm. " "	14′
" 100 Ton Gun (Italian)	4′

These data have been picked out of the Hand Book already referred to, where they incidentally occur in the statement of problems, but whether they are hypothetical or have been ascertained experimentally does not appear, and again we have to regret the absence of authentic information.

We now turn to "Whistler's Graphic Tables of Fire" for the 8" M. L. Rifle. Here we find data officially published as the results of experiments conducted by an experienced, capable and painstaking officer. The tables cover the whole field of practical gunnery for that particular gun, and were devised in order that the solution of problems in gunnery might be brought "within the comprehension of the average non-commissioned officer." There are nine tables in the collection, all graphically presented, but the one that specially interests us at present is No. 6. Table No. 6 graphically represents the "approximate" value of Jump for the 8-inch Muzzle-Loading Rifle, and as it is officially published as the result of experiments, we must consider it the best evidence, so far found, as to the magnitude of Jump. According to that table the Jump of the 8" M. L. R. is as follows:

Elevation.	Jump.	Increment.	Elevation.	Jump.	Increment
0°	9′		6°	21′ 30″	+ 3′ 30″
1°	9′ 30″	+ 30″	7°	24′	+ 2′ 30″
2°	10′ 30″	+ 1′	8°	19′	— 5′
3°	12′	+ 1′ 30″	9°	16′	— 3′
4°	14′ 45″	+ 2′ 45″	10°	14′	— 2′
5°	18′	+ 3′ 15″	11°	13′	— 2′

A glance at the above table shows that the Jump of the 8" Muzzle-Loading Rifle, mounted on the regulation carriage, increases with the elevation, in a constantly increasing ratio until an elevation of something less than 7° is reached, after which it decreases in a more regular and rapid manner. The plus increments from zero to 6° of elevation are 30″, 1′, 1′ 30″, 2′ 45″, 3′ 15″ and 3′ 30″. From 8° to 11° elevation, Jump diminishes; the minus increments being 5′, 3′, 2′ and 2′. We omit the 7° reading, because a little short of that point Jump begins to diminish, that is, the increment changes its sign from plus to minus.

In Germany the Jump is known under the cognomen *Abshiedsfehler*, and due allowance is made for it in their calculations for range. It does not appear, however, from anything that has come under our observation, that it is considered otherwise than as a constant for any particular gun and carriage. Indeed, we have found nowhere in our reading such a detailed exposition of Jump as that given in Whistler's Table No. 6. But then our reading has been limited by the scarcity of literature on the subject.

We now turn to the more difficult branch of our subject, and ask: What is the cause of Jump?

Major McKinley, of the Royal Artillery, in his very excellent text-book on Gunnery, published in 1887, discusses the subject at some length. His theory is that Jump is the result of a combination of conditions which control and direct the actions of the gun and its carriage under the pressure generated in the bore by the combustion of the charge. He says, in effect, that the pressure generated in the bore of the gun has a backward action in the direction of the axis of the gun; but as the gun and its carriage are bound together in one system, the backward pressure changes its direction and tends to produce rotation of the system round its centre of inertia. He says further, that this pressure, which must be enormous, has its effectiveness increased by acting through a lever arm, the length of which is the perpendicular distance between the centre of inertia of the system and the axis of the gun. Moreover, he says, that in

garrison guns, mounted on pneumatic carriages, the pressure in the bore of the gun is greatly reinforced and assisted by the pull of the piston rods acting through a lever the length of which is the perpendicular distance between the heads of the piston rods and the centre of inertia of the system. He then says, and as the assertion is important, we quote his own words, as they may be found on page 102 of his text-book: "These couples, causing the blow on the elevating gear, give rise to the Jump of the gun, and thus more elevation is given, by many minutes, than is intended."

Reduced to its lowest terms, Major McKinley's theory is, that Jump is part of the phenomenon of recoil.

Lieutenant Whistler arrives at his conclusions in the following way. He says, in effect:

1. Jump is a fact. "When a gun is fired, the shot leaves the muzzle at a greater angle of inclination with the horizon than that of the axis of the bore before the piece is fired."

2. "The gun does not turn in the trunnion beds."

3. Jump must be due to some pulsation or movement of the whole system. And the reaction or spring of the carriage "which has been compressed by the downward component of the recoil," will not satisfactorily account for the phenomenon, because "the shot is undoubtedly out of the muzzle before the reaction begins."

4. Jump must therefore be due to the rotation of "the entire system * * * about some point of rest," caused by the force of recoil.

Thus Whistler's theory of the origin of Jump is, practically, that given by McKinley. But Whistler does not stop with the bare enunciation of his theory. He tries, in a very interesting argument, to account for the variability of Jump in the same gun, with the same charge and weight of projectile, but at different angles of elevation. We shall not complicate the issue by any reference to these arguments at present. The question is, what is the cause of Jump? General Tidball, who first noticed it officially in our service, attributes it to "the spring of the carriage." Major McKinley and Lieutenant Whistler claim that it is due to a rotation of the gun and carriage about some point of rest, and that the rotation is due to the action of the force which produces recoil. We do not think that Lieutenant Whistler is justified in assuming that General Tidball—or those who hold "the spring of the carriage" theory—attributes that spring to the reaction due to relief from the downward component of recoil. We have found no such explanation anywhere, and certainly no explanation of any kind is given in the manual.

We have said in a previous paragraph that Major McKinley's explanations are not new and that we have met them many years ago doing duty in another cause We do not claim that they should be discredited on that account. Indeed we have no fault to find with them as explanations. But what do they explain? When we first met them they were advanced in explanation of the phenomena which accompany recoil; and if Jump be one of these phenomena they would still be in point. But is it? This is manifestly a very important question and one which has never been discussed. Let us look at it for a minute.

Major McKinley says that the pressure generated in the bore of the gun has a backward action. Does he mean to infer that it has not also a forward action? It will not be claimed that motion can take place in any direction until the inertia of the shot is overcome—assuming, as we desire to do for the present, that there was no outflow of gas by the vent. But, many assert, when the projectile moves recoil begins. This we have the temerity to deny. We are not unmindful of Newton's Third Law. We claim, however, that it comes into operation, only when the gun and the projectile become two separate and distinct bodies. This they are not, in any physical sense,

until the projectile leaves the bore,—we are considering breech-loading rifles only. While the projectile is traversing the bore, it is part of the envelope which encloses the gases. We do not claim that it is welded to the walls of the gun, but it is in such close contact therewith that gases under the enormous tension of perhaps 30,000 pounds to the square inch are unable to penetrate the joint. The gun and the projectile are practically one body. They constitute the envelope in which the gases are enclosed under very high and, for a time, constantly increasing tension. By and by the envelope yields on its weakest side; but there is no rupture. No gas escapes; pressure is equal in all directions, and motion of the envelope as a whole is absolutely impossible. It is the case of the soap-bubble exactly, only there is no yielding save on one side. (We assume of course that there is no vent.) But the envelope is ruptured when the shot leaves the muzzle and Newton's Third Law then comes into operation. Action and reaction are then equal and opposite and recoil begins. Therefore we say that recoil has nothing to do with Jump in breech-loading rifled guns.

And here we were agreeably interrupted by the arrival of *The Artillery Journal* for October, containing an able article on "Recoil" from the pen of Lieutenant Henry C. Davis, 3d Artillery. Now although we deny that recoil has anything to do with Jump, the subjects are closely akin to each other in the opinion of perhaps a vast majority of Artillery officers, and Lieutenant Davis's paper is a valuable contribution to the controversy. Such a paper cannot be reviewed in a paragraph. We do not pretend to review it; but we find one or two statements so intimately connected with our subject that we cannot help noticing them. One is his estimation of Jump (p. 385), and the other his experiment to determine the beginning of recoil (p. 388).

As to the magnitude of Jump, he says—p. 385—"That its amount is small," and "It will probably be constant." These assumptions are not confirmed by Lieut. Whistler's experiments.

As to the experiment, which was intended to demonstrate that recoil began before the projectile left the muzzle, it is altogether interesting and instructive, and proved the proposition so far as that particular combination is concerned. But it does not establish the general case for breech-loading rifled cannon. There are certain features about a Springfield rifle and its cartridge which disqualify them as representatives of the larger class of guns. The Springfield musket and its cartridge are in reality two guns, one within the other, and the inner one which shoots first, also shoots backward; that is, the gun is shot off the projectile instead of the projectile being shot out of the gun. Army officers have had so much trouble with this feature of the Springfield musket on the rifle range, that there is hardly any excuse for forgetting it when trying a delicate experiment.

The peculiarity to which we refer manifested itself originally in the breaking of the cartridge shell. The break was always the same, and at the same place. A little in front of the base of the shell, the case was cut in two as neatly as if it had been done in a turning lathe. What was the cause of it? Mr. Morse not only answered that question, but proved the accuracy of his answer. Mr. Morse was the author of the breech-loading musket, and no man had a keener eye for cause and consequence than he had. He experimented with the weapon and studied the rupture, until he discovered the cause and the remedy. He explained the rupture in this way. He said, when the cartridge is placed in the chamber, there is, very frequently indeed, almost always—a little jag room between the base of the cartridge and the bottom of the chamber. When the gun is fired, the bullet, without being actually forced into the grooves of the rifling, grips the forward end of the cartridge shell between itself and the walls of the chamber, as tightly as if it were held in a vice. The line of least resistance of this inner envelope is towards the rear, and as the forward end of the

shell is held fast, rupture takes place. In proof of the correctness of his diagnosis, Mr. Morse devised the cartridge shell with movable base, and in this way all but abolished rupture.

Now the force that tears a copper shell in two, is certainly sufficient to produce the recoil observed in Lieutenant Davis's experiment. And that recoil undoubtedly takes place before the bullet is forced into the grooves of the gun. But that does not establish the general case for breech-loading cannon, in the chambers of which the gases have freedom of action. The gun within a gun, shooting in opposite directions, is a special case and cannot therefore be called decisive. Still it presents some interesting phenomena, and according to our theory, ought to materially affect the accuracy of the shooting. Indeed, if we remember rightly, the breaking of the cartridge shells was always accompanied by bad shooting, which would be the natural and necessary consequence of recoil before the bullet left the muzzle.

On a calm review of the evidence thus far adduced we are compelled to say that we see nothing in it that satisfactorily accounts for Jump where there is no escape of gas by way of the muzzle, and no gun within a gun. Assuming that Lieut. Whistler's table is correct—and we have no doubt of it—any theory of Jump which does not explain its variability must be unsatisfactory. Of course, in smooth-bore guns, and to a certain extent perhaps in muzzle-loading rifles, gas does escape by way of the muzzle, and wherever such escape exists there must be backward reaction proportionate to the velocity and volume of the escape. But whether that reaction is sufficient to overcome the inertia of the gun and its carriage and produce positive motion remains unproved. That the escape of gas through the windage in smooth-bore guns is considerable, is admitted; but in muzzle-loading rifles the fact that it is insufficient to ignite a fuse, proves that it must be insignificant. Before the base-ring of the projectile expands into the grooves, some gas may escape, and there may be some reaction, but we cannot admit, on the evidence so far presented, that it is sufficient to produce recoil. In the case of breech-loading cannon we hold it to be impossible.

But, for the sake of argument, let us admit for the moment that recoil does begin, even in breech loading rifles, at the instant the shot begins to move, and that Jump is produced by the "*Force of Recoil*," either because it operates to rotate the whole system about its common centre of inertia as Major McKinley asserts, or by a lifting process as maintained by Lieut. Whistler. Will either of these theories account for the variability of Jump?

When Major McKinley wrote, Jump was an infant and its variability was unknown. That feature, therefore, does not enter into his discussion of the subject. But it is the very key-note of Lieut. Whistler's argument. He recognized that any explanation which does not account for it must be unsatisfactory. The irregular increase of Jump with the elevation of the gun up to 6°, 50', and its subsequent more rapid and regular decrease, were features so unique and extraordinary, that they could not be overlooked. So we find a very interesting and ingenious argument on this point, in Lieut Whistler's explanation. He says in effect:—

That the *Power* which operates to lift the front part of the carriage in this case is a component of the force of recoil. That the *Weight* to be raised is the gun, carriage and chassis. And that the pivot on which both power and weight operate, is the lower element of the traverse wheels. That the power and the weight both operate through variable lever arms, being, in the case of the power, the distance from its point of application to the point of rest; and in the case of the weight, the distance from the centre of inertia of the system to the same point of rest. That as recoil proceeds, the lever arm of the power shortens much more rapidly than the lever arm of the weight. And that, so long as the top carriage remains stationary, the power is able to lift the front

end of the carriage, but that the moment recoil begins its lever arm shortens so rapidly that the whole system begins to drop.

And this, according to Lieutenant Whistler, accounts for the variations in the magnitude of Jump. But the explanation will not be entirely satisfactory to everybody. The element of time—less than the fiftieth part of a second, perhaps—which intervenes between motion in the shot and its exit at the muzzle, will not admit of much recoil without assuming an initial velocity of recoil altogether inconsistent with observed facts. The possible variations therefore, in the relative lengths of the lever arms, would seem to be altogether inadequate to produce the results.

Such a conclusion, honestly reached and conscientiously believed, will naturally induce the believer to search for some more plausible explanation, and if he believes that gases, at whatever tension, enclosed in an envelope strong enough to hold them, cannot produce motion until that envelope is ruptured or the gases find an outlet somewhere, he will, as naturally, turn his attention to the vent. Hitherto the vent has not entered into the discussion. Perhaps it is too insignificant to find a place in this argument. Still, it is a fountain of force, in active operation during the production of the phenomenon under discussion, and must have some effect upon it even if it does not create it. From the ignition of the charge to the movement of the shot, and until the shot leaves the muzzle, gas is rushing through the vent with terrific velocity. What that velocity is, and what the consequent reaction is, we leave to abler physicists to determine. We are satisfied, at present, with the certainty that potential energy is being rapidly converted into kinetic, by the outflow through the vent. Action and reaction are in active operation, and the reaction operates in a direction and at a time which must make it, if not the sole agent, certainly a very important one, in the production of Jump and all its vagaries.

Remembering that Lieutenant Whistler has demonstrated that the "gun does not turn in its trunnion-beds," and rejecting, for the moment, McKinley's rotation and Whistler's lifting theories, we ask, how could Jump be produced? Would momentary flexure of the chassis rails do it? The chassis rails are strong and substantial no doubt, but they are not altogether rigid. And they are supported in a way that would make a blow delivered at their middle points most effective. And the heels of the shoes of the top carriage rest about there when the gun is in position for firing. And the heels of the shoes support the elevating screw. And the reaction from the vent acts directly on the head of that screw. So whatever that reaction may actually be, every ounce of it is instantly delivered on the chassis rails at the point where flexure can be most easily accomplished. Here then we have a force, acting for the fiftieth part of a second, at the point, and at the time, and in the direction, required to produce the phenomenon of Jump. Is it a horrible heresy to say that it does produce it?

But would a force operating in the manner described, in connection with changes of elevation of the gun, produce or tend to produce the observed vagaries in the magnitude of Jump? Let us look into that for a moment.

It is clear that the reaction due to the vent outflow must vary directly with the outflow, and that the outflow depends upon the tension of the gases in the gun-chamber. Anything therefore that increases that tension, must also increase the outflow and reaction. Now, anything that increases the inertia of the shot, must increase the tension of the gases in the gun chamber before that inertia is overcome and, when the gun is elevated above the horizontal, a component of gravity appears which opposes the movement of the shot and therefore increases its inertia. We should expect, therefore, that Jump would increase with the elevation of the gun.

But there is another element to be taken into consideration. Increased elevation of the gun is accompanied by diminished angle of incidence of the blow delivered on

the head of the elevating screw, and therefore a diminished component of that blow is transmitted to the chassis-rails. The effective force then, which operates to produce flexure of the chassis-rails is composed of two elements, a positive and a negative. Calling the positive element (that is, the element due to gravity), x, and the negative (that due to the angle of incidence), y, the force operating to produce flexure of the chassis-rails at any moment, would be x-y.

Now x increases with the sine of the angle of elevation, and y increases with the cosine of that angle. Beginning at zero then, the increments of x for each degree would be proportional to the increments of the sine of the angle of elevation, and the increments of y would be proportional to the increments of the cosine of that angle. x and y would therefore increase in the following ratios:

Ratio of increase of x.	*Ratio of increase of y.*
For 1° as 1. to .01745	For 1° as 1. to .00015
2° " " .01745	2° " " .00046
3° " " .01744	3° " " .00076
4° " " .01742	4° " " .00107
5° " " .01740	5° " " .00137
6° " " .01737	6° " " .00167

So we see that while the value of x goes on increasing with the elevation, it does so in a decreasing ratio while y increases in an increasing ratio. It is evident then, that although the force due to reaction from the vent outflow increases with the elevation, the portion of it effectively delivered on the chassis-rails is constantly diminishing, and that there must be an angle of elevation at which the increment of x will be wholly negatived by the increment of y. Above that elevation the effective force will diminish rapidly, and Jump will finally disappear.

Any believer in the vent origin of Jump and the accuracy of Whistler's table No. 6, will find a confirmation of his creed in the sudden change in the direction of the Jump curve at 6° 50′ gun-elevation. He will feel inclined to assert that at 6° 50′ plus the angle of inclination of the chassis-rails, the increment of y wholly negatives the increment of x. Of course he would find some difficulty in proving it. There are too many unknown quantities in the problem The velocity of the vent outflow and its reaction; the maximum flexure of the chassis-rail within the limit of permanent set; the amount of flexure necessary to produce one minute of Jump, and the pressure or blow necessary to produce that flexure, are all unknown quantities so far as our knowledge extends. We leave the problem, therefore, in the hands of some one better able to deal with it than ourselves.

There are some minor phenomena, intimately associated with Jump and Recoil, which we have purposely omitted for the sake of simplifying the issue. Among these may be mentioned the reaction due to the expulsion of the column of air which fills the bore in front of the projectile. That of course should be taken into consideration in any exhaustive treatment of the subject, although its insignificance is almost established by the fact that blank cartridges rarely produce perceptible recoil. We hope the theory will be fully discussed. We are not wedded to our own opinions, but we believe that the vent is an important, if not the only agent in the production of the phenomenon.

Reprints and Translations.*

NOTES OF LECTURES ON ARTILLERY IN COAST DEFENSE.

(Proceedings of the Royal Artillery Institution.)

By MAJOR A. C. HANSARD, R. A., Instructor of Gunnery.

(By permission.)

THE following notes of a course of lectures are published in the hope that they may be found useful. The lectures were based on the instructions contained in the "Provisional Manual of Tactical Working of Coast Artillery," and other official publications. In addition great use has been made, in that part of them relating to fire tactics, of "Fortification," by Major Clarke, R. E., "Brassey's Naval Annual," various papers published in R. A. I. "Proceedings," etc.

PART I.

In these lectures it is proposed to consider the arrangements which have to be made and the methods which are adopted to secure the efficiency of the artillery of a coast fortress to repel attacks by sea.

The very important branches of the general subject of coast defense, which include submarine mining and the employment of coast defense vessels to aid the artillery defense are not treated of, as not falling within our province as gunners. In considering how best to employ the guns of a coast fortress the following questions present themselves:

(*a*) What preliminary arrangements must be made in order that an effective fire may be opened at the right moment, and maintained until its object is accomplished?

(*b*) By which fort or guns should each of the enemy's ships be attacked? at what part of the ship should the fire be directed? and with what projectiles?

(*c*) How shall we ascertain the correct elevation and direction in order that the projectiles may hit the right spot? in other words, how shall we control the trajectory? And, lastly,

(*d*) How shall we insure that the results of successive rounds shall be consistent? in other words, that there shall be no irregularity in the shooting due to preventible causes?

The answers to question (*a*) we consider under "Organization"; the question (*b*) are treated of under the heading "Fire Tactics"; to (*c*) under "Fire Control"; and to (*d*) under "Fire Discipline."

* Please address communications concerning reprints, translations and reviews to Lieut J. C. Bush, editor of this department.

Before proceeding to consider "Organization" a few definitions are, perhaps, necessary. A "Coast Fortress" is defined as an area of land and sea, provided at certain points with an artillery armament, partly "fixed," partly "movable," and its area is the extent of land and water which can be covered by the fire of its guns; the water area is the part with which we are concerned.

The "fixed armament" consists of such guns as are mounted on garrison mountings in permanent positions of whatever nature. It is divided into two classes, the "primary" and the "secondary" armament.

The "primary armament" consists of R.M.L. guns of seven inches and upwards, and of B.L. guns of six inches and upwards (and possibly the 6-inch quick-firing gun if introduced for land service). These guns fire armor-piercing projectiles, and would be used to attack the armored portion of vessels as well as the unprotected parts. The "secondary armament" consists of the lighter natures of R.M.L. and B.L. guns, of R.B.L. guns, and quick-firing guns on garrison mountings, whose function would be to keep up a rapid shell fire on the unarmored portions or the ports of an enemy's vessels, and to repel boat attacks, or attempts to land troops, and in some cases to assist in the protection of mine fields.

The "movable armament" consists of siege guns and howitzers, field, machine and quick-firing guns on travelling carriages. They would be employed sometimes in prepared emplacements inside the forts to intensify the shell fire of the secondary armament and generally to assist it in the various tasks mentioned above; more usually they would be placed outside the fort in selected positions. Howitzers would be placed in concealed batteries where possible for the purpose of employing high-angle fire at ships' decks. This part of the armament would take part largely in the defense of land fronts.

A perfect artillery organization is only attained when the forts can be manned and a rapid and effective fire opened at the best objectives in the shortest possible time; and such a fire kept up until the desired object has been accomplished.

In order to attain this end it is in the first place necessary that, as far as possible, every man in the garrison should know his station and duties in action, and that a proper chain of responsibility should be established. In the next place that the best methods for storing ammunition and supplying it rapidly to the guns, and of replacing without delay casualties to men or stores, should be devised. Further, that the best means available are made use of for communicating orders, for indicating objectives, for finding and communicating ranges and deflections, and for observing the results of fire, and that they are thoroughly understood by all concerned. Lastly, that the possible modes of attack by an enemy's fleet should have been thought out beforehand and schemes of defense drawn out; so that no waste of time and ammunition through firing at improper objectives may take place.

In the first place then the fortress must be split up into tactical units, each under a commander who will have, in action, a definite task to perform, which will usually be the defense of a certain portion of the water area; for instance, an entrance to the harbor or a bay from which an enemy

might endeavor to bombard a dockyard, or to effect a landing, etc. Next, an economical but efficient scheme for manning the various guns and works of each unit must be drawn up.

The largest tactical unit is termed a "Section," and its commander a "Section Commander." This officer may be of any rank and arm, and if not an artillery officer will have on his staff the "Section C.R.A.," who will command that arm.

A "Section" consists of such forts and batteries as bear on the area which the section commander has to defend; the principle on which the fortress is divided being, that each section commander should only have to control one distinct action at a time.

There would also be mine-fields, coast-defense vessels, etc., under his control; these latter to provide the power of counter-attack on the water, the artillery defense being necessarily passive.

The next tactical unit is the "Fort" under a "Fort Commander." It must be understood that the tactical meaning of the term "fort" includes not only closed works, but any battery, or group of batteries or works, which, for purposes of fire control, are placed under one command. Just as a section commander should usually only have to control one action at a time, that is to fight an enemy's squadron attempting one definite object; so the fort commander, as a rule, would have to fight only one of the enemy's vessels at a time; consequently the guns placed under his command will all approximately be able to be brought to bear on one objective, not necessarily at the same moment, but at any rate consecutively. The section and fort commanders are in an analogous position to the officer in command of a squadron and the captains of the ships of that squadron, the O.C. of the squadron exercising tactical control over his ships and directing them against the proper objectives, as the section commander does with his forts; while the captains of ships and fort commanders fight their ships or forts to the best advantage against the objectives pointed out to them.

The next lower tactical unit is the "Group" under a "Group Officer." A group consists of such a number of guns as from their position can be conveniently supervised and commanded by one officer. The guns of each group must not be too many in number, therefore, or too far apart; each group *must* consist entirely of guns which can be brought to bear on the same objective; and should be of the same nature and calibre; and at the same height, approximately, above sea level.

The group is the ultimate tactical unit, its guns being always fought at the same objective; they must, therefore, all be able to bear on one spot or some will always be out of action, and if of different natures they will often require to be laid at different ranges to hit the same mark, and may require to use different projectiles against any given ship, thus making the fire discipline exceedingly complicated and likely to break down.

Under the group officers are the gun captains in charge of the detachment and stores of a single gun, for which they are responsible to the group officer. The single gun is the unit of organization though, as said above, the group is the smallest *tactical* unit.

In some cases a single gun constitutes a group by itself; when the gun

captain may be required to perform the duties of group officer as well as his own.

Under ordinary circumstances then the chain of responsibility is as follows:—

The section C.R.A. directs the action of the forts in the section.

The fort commander controls the fire of the groups in his fort.

The group officer is responsible for the fire discipline of his guns.

But circumstances sometimes render necessary additional links in the chain.

For instance, as has been said above, the section commander should only have to conduct one action at a time, but for various reasons it may be thought advisable to put under his administrative command forts which do not bear on the water area with whose defense he is primarily concerned; and which might, therefore, become engaged in a distinct action with a detached squadron of the enemy's fleet.

In order to avoid the loss of control and consequent loss of power which would be involved if the section commander had to give his attention to two separate battles, a link is interposed between him and the fort commanders for that part of the section which is the least important, the tactical control of that part being placed in the hands of a "Sub-section Commander," who exercises over it in action the same control as a section commander, subject only to general directions as to his tactics from the officer commanding the whole section.

An isolated fort might sometimes be constituted a "Sub-section," in which case the fort commander would become also sub-section commander.

Similarly some faces of a fort or flanking batteries may be so placed that their guns could not be engaging the same vessel as the main fronts. Loss of control and power would result if the group officers of these faces or batteries were left to direct their fire on objectives of their own choice, so "Sub-commanders" are appointed for such parts of a fort, who have the same powers of fire control over the groups placed under them as a fort commander, receiving from him general directions as to the objectives they are to attack.

In cases where the most important groups of a fort are fought by position-finder, whilst less important groups are fought by depression range-finder, sub-commanders would be appointed for the depression range-finder groups as also for batteries of movable armament placed outside the fort.

Where a sub-command consists of only one group of guns, the group officer would be treated as a sub-commander.

Certain groups of heavy guns having a wide field of fire and fought by position-finders are sometimes taken out of the fort commander's control and kept directly under the orders of the Section C.R.A., who exercises fire control over them through a staff officer at his fighting station. The rôle of these guns is analogous to that of the corps artillery of an army corps. They would be used to support the action of any fort which, in the opinion of the section commander, might require assistance in engaging the objectives allotted to it.

Besides these officers who exercise tactical control or fire control over

the various units and whose duties we shall consider under the heads of fire tactics, fire control, and fire discipline, there are others who have special duties to perform; these are sub-commanders (for discipline), ammunition officers, and electric light officers, who are all under the orders of the fort commanders, with the exception of officers in charge of section commander's lights.

The "Sub-Commander for discipline" is the representative of the fort commander on the gun floor. His presence is rendered necessary when, as is usually the case with guns of the primary armament, the fort commander has his station at some distance from the groups, near the instruments (range or position-finders), by the aid of which he controls their fire.

In such cases a sub-commander is appointed to see that the fort commander's orders are carried out and to supervise and assist the group officers.

His duties must not be confounded with those of a "Sub-Commander with fire control" who actually fights the guns under him, while this officer has nothing to do with the fighting of the guns.

His chief duty will be the general supervision of the discipline of the gun floor; he will have to see to the prompt transmission of orders from the fort commander to the group officers; he will have to superintend the removal of wounded and to the replacement of casualties among men or stores, for which purpose a portion of the reserve would be placed under his orders; and he would be in direct communication with the fort commander.

He would not interfere (unless ordered) with the group officers as regards the fighting of the guns, nor with the ammunition officer; but should a group for any reason become disorganized and its shooting consequently unreliable, he will cause it to cease firing, reporting the fact to the fort commander.

Electric lights are used for two distinct purposes, and are controlled according to the purpose for which used.

Search lights are mainly used for finding out the position of an enemy's vessels, and are controlled by the section commander.

Fighting lights are used principally for lighting up the vessels when found, and each fort commander would usually have one such light under his control.

The means of generating the light, and of keeping it in action, are intrusted to the R.E., but with each light there will be two men of the R.A to elevate and traverse it under the direction of an R.A. officer (or N.-C. officer).

The system on which these lights are worked (only provisional at present) is shortly as follows. The section commander's search light (assisted sometimes by some of the fighting lights) searches the water area of the section in successive zones, and when an object is found the section commander orders a fort commander to direct his light on that object and engage it; as soon as the fighting light is thrown on to it, the search light is taken off and continues to search the rest of the area. When a vessel is about to pass out of the fire area of a fort, the next fort commander is

ordered to light up and engage it, and so on. Fighting lights have stops or shades so arranged that they cannot accidentally light up friendly works. They are usually placed outside and at some distance from the fort, but are in direct communication by telephone or telegraph with the fort commander's station. The section commander controls his search light direct through his electric light officer, and the fighting lights, when he requires them for searching, through the fort commanders.

Ammunition officers are in command of the details of men required for the supply of ammunition to the gun floor from the magazines. It is their duty to superintend the whole of the operations on the magazine floor, to see that every man knows his post and his duty, and that the magazine regulations are strictly obeyed; they must keep exact account of the ammunition expended and render a report of it and of the amount remaining in expense stores and magazines at the end of the action, or when required, to the fort commander. They must see that no delay occurs in supplying the guns, and must give timely notice to the fort commander when the expense stores, etc., are becoming exhausted. All unexpended ammunition should at once be returned to the expense stores on completion of the action. In very large works one or more officers or N.-C. officers would be detailed to help the ammunition officer: while in small works a N.-C. officer might perform his duties.

The provision of an economical but efficient manning detail for each fort is the next necessity. This detail is made out on Army Form A 2008, and it is divided under five separate headings.

The first division is the "Fort Commander's staff." This consists of the officers or N.-C. officers required to assist the fort commander at his fighting station with his observing instruments and charts, of position-finder observers, telegraphists, and telephonists, who would be trained men of the district establishment, of depression range-finder detachments, and of orderlies, trumpeters, and signallers as required. Sub-commanders for fire control, with their staffs, and sub-commanders for discipline, would also be included under this heading.

The "permanent fort staff" is the next heading. This consists of the master gunner and his assistants who are in charge of the equipment of the fort, of the district gunners and artificers; the master-gunner would be on the gun floor and the district gunners in the artillery general store, and other stores and side-arm sheds, and in charge of the lamps for lighting magazines and passages; these men belong to the district establishment or are specially detailed for the duty from R.A. companies.

"Detached armament and other details" include the officers and men required for groups of movable armament stationed outside the fort, and electric light details.

The "group details" consist for each group of a group officer and the detachments for the guns of the group, and one or more dial numbers. Each detachment must, of course, include a N.-C. officer as gun captain, and at least one trained layer.

Lastly comes the "ammunition detail" under the ammunition officer.

The manner of drawing this out depends on the mode of supply to the

guns. Guns may be supplied from expense stores and magazines, these being filled up from time to time from the main magazine and shell store. In this case from one to four men will be required in each store, etc., according to the number of guns to be supplied and the weight of the ammunition to be handled. One man should be specially told off to have charge of the supply of tubes and fuses where these are kept in expense shell stores. At least one man must be posted at the top and bottom of each lift, who will send and receive all messages from the gun floor; and, if the lifts are some distance from the stores, a sufficient number of men must be at the bottom to insure a constant supply of ammunition. In some cases guns may be supplied direct from the main magazine and shell store. More men may then be required as the guns will be further from the stores or lifts, but the actual number will vary greatly with the nature of the work.

In either method of supply where one lift has to serve many guns, it will be difficult to arrange for an equally rapid delivery to all of them, and this would be fatal to rapid fire; since groups are usually fired by salvos the slowest loading guns would delay the others. To obviate this, temporary depots are established on the gun floor, out of danger of chance shots, where a few shell can be stored. Depots for cartridges may sometmes have to be similarly established. These depots must be kept filled from the lifts or main stores by men detailed from the ammunition detail. With guns whose cartridges are brought up in zinc cylinders, a few men must be told off to collect and stack them out of the way of the working of the guns. The responsibility of the ammunition detail extends as far as the delivery at the depots or at the head of the lifts, the service thence to the guns being carried out by the gun detachments. A N.-C. officer should be told off to superintend the filling up of depots from lifts, as the ammunition officer, being on the magazine floor, will not be able to do so.

If any men of the companies told off to man the work are available after these details are completed they will form the reserve and be placed under the orders of the sub-commander. They will be employed in bringing up spare stores as required, in replenishing expense magazines and stores from main store, etc., if necessary, and from their number casualties among the details will be replaced.

If a long bombardment is expected, arrangements would have to be made and noted on the manning detail for relieving at least a part of the details at stated intervals.

To enable every man to know and recognize his post, and to facilitate the supply of ammunition and stores, each group has a letter and symbol allotted to it, the letters commencing with the group on the right of the work, and the guns are numbered from the right in each group. Each gun is marked with its group symbol and letter, and its number in the group. Every store, side-arm shed, lift, speaking tube, etc., which is allotted to the service of a group is marked with the symbol and letter, and if to a particular gun or guns with their group numbers in addition; every article belonging to a gun should be marked or be placed under a label with the symbol and number on it. The route which ammunition should follow

should be shown by arrows, accompanied by the same marks, also the way to side-arm sheds, etc.

The various details are paraded at the alarm post in the formation best suited to the ground, the gun detachments being told off previously to marching off. The ammunition detail should be first moved off, then the fort commander's staff, lastly, the group details in succession. This is because the ammunition detail will take the longest time to get ready, as some of them will have to change into magazine clothing. The staff will have to get their instruments ready, and all this must be done before the guns can be fired. When details are marched into works with which they are not acquainted, guides must be detailed from the permanent staff to show them the way to their posts.

Troops have sometimes to be sent by boat to man forts and cannot be told off beforehand, it would cause delay to wait till successive boat-loads had all landed before distributing the men, and in that case it would be found convenient to have painted on a wall at or near the landing place a sort of epitome of the manning table, for instance, a part might read as follows:—

(*A*)	(*B*)
1 Officer.	1 Officer.
2 9″ R.M.L.	4 10″ R.M.L., etc.
1 Dial.	1 Dial.

Supposing the ammunition detail to have been completed the officer in charge of the next boat-loads that arrived would see that two detachments for 9″ were required and a dial number, and would parade sufficient men for that purpose and march them into the work. The (*A*) group mark would then be chalked out, and the next officer would fall in his men opposite (*B*) group symbol and march off as soon as he had sufficient men to make up the required detail, and so on.

Previously to manning, orders would be issued as to the disposal of removable bulkheads, beds, bedding, and barrack furniture from casemates; the men's carbines and belts should be disposed in the racks so that each man could find his own at once should an assault render it necessary to resort to their use.

Hand lamps should be provided for reading elevation and training, and lighted as soon as the guns are manned, care being taken at night that their light does not show through the ports. These lamps will be required in casemates even by daylight when the smoke becomes very thick.

The permanent staff do not parade with the detail, but on the sounding of the assembly would proceed to their stations, light the magazine lamps, open stores, and prepare to issue stores.

The next division of this part of the subject was the storage and supply of ammunition. Beyond what has been said above on these points, it should be noted that Palliser shot and case shot are stacked on the gun floor between or in rear of the guns, shell filled and plugged are stored in main and expense shell stores and cartridges in zinc cylinders in main and expense magazines; when the expense magazines are damp they are sometimes left empty; but in view of a possible attack (which might at distant stations be

the first intimation of the declaration of war) the cartridges must be in them, and being in air-tight cylinders it is difficult to see how they could take any harm. Automatic gas-checks and wedge-wads are usually kept in the artillery general stores. Tubes and fuses are kept in expense shell stores, or in cupboards inside the head of the shell lifts.

Ammunition is arranged in the magazines in batches (called ammunition groups) according to the age and brand of powder or mark of shell. It is most important that this should be properly carried out as different batches of cartridges will not give the same muzzle velocity, and consequently ranges will differ and the correction of elevation would become impossible if batches are used indiscriminately. Batches must consequently be distinctly marked with their number so that they can be easily distinguished in a dim light. They must also be so arranged in the magazines that the guns of a group may all be supplied with the same batch for an equal number of rounds. In action it would be the duty of the ammunition officer to select the batch to be issued, usually the largest would be first used, though at peace practice small batches may require to be used up to prevent accumulations.

In allotting lifts and stores to the service of groups or special guns, the principle kept in view is that the supply to every gun of a group should be equally rapid. If it can by any means be avoided a lift should not be allotted to guns of different groups or of different calibres; this will not be quite so important, however, if temporary depots are established, as less risk of confusion and error in taking up ammunition to the guns is then likely to occur.

Recesses for a few cartridges or shells are sometimes provided in the parapets; these would be filled in anticipation of an action, but this ammunition should not be used except in an emergency, such as the break down of a lift, or the sudden necessity for very heavy fire.

The means of communicating orders, indicating objectives, and finding and communicating ranges, etc., must be the next care.

For communicating orders no special means are at present provided but probably will be shortly; in the meantime orders must be sent by word of mouth through speaking tubes or telephones, or where these are not available by a combination of trumpet calls and flag signals, a code for this is given in the "Tactical Manual," but whatever signals are adopted they should be clearly understood by all concerned, and they should be so arranged that they cannot be mistaken for one another. The most important orders to be communicated are those with regard to the ammunition to be used and the rate of firing, and the orders to commence and cease firing. If orders have to be sent by orderlies they should be sent on the authorized message form, properly addressed, and with the hour of departure entered, officers receiving them should initial them and mark time of receipt.

For indicating objectives various instrumental systems have been proposed, but none have been so far adopted, an objection to such systems is the introduction of additional instruments, requiring highly-trained men to work them, and the loss of time in taking the observations. The system of indicating by squares seems so far to have given the best results. In this

system all the charts of the sea area are divided up into squares of 400 yards side and numbered. On the section commander's chart the squares on which the groups of a given fort can bear are marked with a band of color, each fort having a color allotted to it, and the band is made darker or lighter according to the number of groups that can bear. The chart being fixed under the position-finding instrument at the section commander's station the pointer attached to the instrument shows in which square the object is when the telescope is directed on it. The fort commander's chart is similarly divided and numbered, and the squares show the groups which can bear on them; and if he has a position-finder at his station the chart is mounted under it, then, by bringing the pencil over a given square and looking through the telescope, any object in that square will be seen. A similar chart is mounted under each position-finding instrument.

When guns are fought by depression range-finder the group officers and depression range-finder observers are supplied with cards showing the range and training to the centre of each square on which they can bear; electric-light officers are supplied with similar cards. The system of using these charts and cards is as follows: The section commander's observer picks up the object with the instrument and notes on which square it is; the number of the square is telegraphed by the section commander to the fort commander the fire of whose fort he wishes to direct on that object; this number is passed on by the fort commander to group officers and to depression range-finder observers, who, by aid of their cards, direct the guns and instruments on the square, and are so made acquainted with the object on which fire is to be directed.

As regards the means of finding and communicating ranges, the instruments in use for coast batteries are the position-finder and the depression range-finder and it is only with these that the ranges to moving objects can be sufficiently quickly and accurately taken; though, of course, any range-finder available could be used for a standing object, or from a high battery the angle of depression could be measured by laying a gun on the object, point blank, and measuring the angle of depression with a clinometer, using the formula

$$\frac{\text{Height of gun in feet} \times 1146}{\text{Minutes in angle of depression}} = \text{Range in yards.}$$

The position-finders are worked by specially trained men of the district establishment; the instrument communicates electrically the range and training to dials fixed near the guns, and are there read off by the dial number. The depression range-finder requires a detachment of three, the observer follows up the object, keeping the cross-wires on the water-line at the bow, or if that is not visible at the stern (gun-layers are instructed to lay on the same points), the drum-reader reads out the ranges as they alter at such intervals as the fort commander directs, usually every 50, 100, or 200 yards; and the dial number adds or subtracts, from the range read out, the correction ordered by the fort commander and shows the corrected range on the dial. This range is copied on the group dials as often as it changes, and the dial numbers should be trained to do this as quickly as

possible"; if any delay occurs, and especially if the delays are irregular, inaccuracy of shooting must result.

If the fort commander orders a correction which is an uneven multiple of 25 and the ranges are read from the drum at the 50 and 100 yards graduations, the dial will show ranges ending in 25 or 75, this will make it likely that they will be wrongly read by the group dials, and the group officer's correction for displacement will not be so easily made, it would then be better that the ranges should be read out at the intermediate graduations; thus if the ranges read out are 1800, 1850, etc., and the fort commander's correction is + 75, the range shown would be 1875, 1925, etc., but if the ranges are read out at 1825, 1875, etc., the dial would show 1900, 1950, etc. Of course, the fort commander's dial must not be so placed that the range could be read from the sea.

In some cases electric dials similar to those used with position-finder are supplied, this is a great improvement, the dial number has then only to watch his dial and read out the range as it alters.

The possibility of obtaining accurate shooting depends on the accuracy of observation of the results of fire, and correcting subsequent rounds accordingly.

At peace practice, by the aid of look-out parties, plane tables, etc., this can be very accurately done, but under service conditions, such as a rapidly moving target covered at intervals by its own smoke and with, perhaps, several forts firing at it, such assistance could not be relied on. It would be better to train officers to judge the results of their fire without such extraneous aids, and it is much to be regretted that, owing to the small quantity of ammunition available, so few have a chance of such training.

With the position-finder, when the splash of the shot can be seen, the error in range and direction can be quickly ascertained by the instrument.

With depression range-finder also the error in elevation can be obtained by taking the range to the splash; it is very desirable that a second instrument should be provided at the fort commander's station for this purpose.

The possible modes of attack of the fortress, having regard to the probable strength and composition of any fleet that might be brought against it would be considered, and the best mode of resisting each such attack laid down. Instructions, based on these schemes of defense, would be issued to section commanders and fort commanders to guide their action.

All information as regards the organization and the schemes of defense are kept in record books.

In every fort there is such a book kept up to date, and giving full details on all the points which have been mentioned, besides others, such as barrack and camping accommodation for the garrison, water supply, facilities for landing men for reliefs, etc., position of mine-fields, with ranges and trainings from the guns told off for their defense, positions for movable armament with ranges to landing places, etc., position and ranges to datum points for position-finder and depression range-finder instruments. Also details of the armament and spare stores, capacity and contents of the magazines, etc. Also the object of the work in the scheme of defense and its relation to other works, and the action to be taken when attacked.

Accompanying the record book would be a detailed plan of the fort showing the grouping of the guns, allotment of lifts, etc., to the groups and position of all fighting stations, etc. A chart of the sea area copied from the Admiralty chart would give on it all information with reference to height and set of tides, depth of water channels, position of five and three-fathom lines, and should have marked on it the arcs of fire of the guns and their extreme ranges, also any directions in which it would be dangerous to fire for fear of damage to friendly works. There should be marked ranges to datum points from position-finder and depression range-finder stations, and ranges from guns to conspicuous objects to centre of channels and to five fathom line in given directions; also limits of range of electric lights (this is not much more than 2000 yards under favorable conditions, rapidly diminishing with the presence of mist or smoke).

There would be also a map of the land covered by the fire of the fort, if any, with similar information on it, to enable fire to be opened as speedily as possible at known distances. In the fort commander's station must also be provided lists of foreign ships arranged under "types," with description and directions how to employ the guns of the fort to the greatest advantage against each type, and tables for correcting range and deflection when depression range-finder is used.

Similar books and charts are provided at the section commander's station dealing with the whole section, and containing instructions for fighting the section against squadrons of different strength and composition; also lists of foreign vessels, giving descriptions by which they may be recognized, and showing roughly what each fort would be capable of doing if ordered to attack them.

(*To be continued.*)

INFANTRY IN COMBAT.

Translated by

FIRST-LIEUT. JOSEPH B. BATCHELOR, 24TH INFANTRY.

(*From the Journal des Sciences Militaires*).

THE OFFENSIVE.

SINCE 1870, military writers of all sorts call on the battle of St. Privât to furnish proofs in support of their systems, yet without exhausting the subject.

That battle abundantly proved the assault of a position to be one of the most difficult operations of war, and that infantry entrusted with this deciding act of the combat cannot succeed as long as the position is held by the enemy's infantry, in good condition and resolved to use their weapons with energy, and to hold their ground. This is not shown merely at St. Privât; many other battles have taught the same lesson in the past, and many will teach it in future.

There is another lesson which may be drawn clear and complete from

the study of this battle, which seems to have been almost overlooked. It seems well to set it in the light, and to ask our comrades of the infantry to think of it.

At St. Privât, the Prussians could place in battery, against the village held by the 6th Corps, 120 pieces of artillery. From 10 A. M. to 5 P. M., the hour of the famous assault, this formidable artillery fired on the village and on our troops, without even the trouble of silencing opposing batteries, since the French had no batteries opposed to them. For seven hours, alone, deprived of the help of other arms, on open ground, without shelters, since they had not even the tools for their construction, our infantry was subjected to the fire of the Prussian artillery. Fettered by absurd routine, as it would be to-day, in repose and inaction, it did not fire a shot, during the cannonade, on the hostile batteries aligned before it.

What other artillery will ever have the same advantage in its work of preparing the assault of its infantry? Time, numbers, superior material,—everything it could wish! Nothing to hinder its work! Nothing to disturb the calm of the Prussian infantry, defiladed in rear of the guns and waiting until the road should be well opened for its march to the assault!

Well, what result was gained by the German commanders from the correct application of the rules then justly held in honor among them, since their artillery was better than ours and their rifles not so good? Every one knows this result, but who has thus far deduced the true conclusion? At about 5 P. M. the Prussian Guard thought us ruined; it thought us crushed by a fire of seven hours' duration, unable to resist an assault. Accordingly it moved forward; but in a quarter of an hour these splendid troops were stopped, destroyed, mowed down by the infantry of the 6th Corps, which had remained intact, materially and morally.

The lesson is clear; *the action of artillery against infantry is inefficacious; artillery does not destroy unsheltered infantry, it does not disperse or demoralize infantry in the positions which it is its mission to defend.*

At St. Privât the Prussian Guard trusted to the power and efficacy of its artillery to prepare its attack, and cruelly repented of its confidence. The supreme arbiter of the battle is not artillery; it makes a great noise, but kills few people.

Now to push forward and drive the assault to victory, we must kill a great many; we must cover the coveted position with dead and wounded; this can be done only by infantry fire, the great destroyer, that is, the great factor of victory;—a fact asserted with grim eloquence by all the statistics of war.

"But," it may be said, "it is a different thing now. Our guns have marvellous range and accuracy. Our shells are very different from those of 1870. Their effects will be unparalleled, superior in deadliness to anything yet seen even to the hail of projectiles or those famous 'jets of bullets'* as the Russian general Zeddeler called the volleys of the Ottoman infantry in 1877–78."

Those who argue in this way are too eager to claim omnipotence for

* "Coups d'arrosoir."

their weapon. As for us infantrymen, who will have to feel its effects, we have a different belief, and we are sure that when we hold a position it will not be artillery that will force us to let go; if there is nothing else to hurt us, we will always be able to receive the assault as the infantry of the 6th Corps received the Prussian Guard.

Let us add that whatever promises our artillery may make of overturning or beating down every obstacle in the way of our assault, we prefer not to leave them the whole task. We think it right to insist on completing their action by our own, by putting the rifle to work, and on contributing to the preparation of the assault by our fire, ably and wisely conducted before launching our force for the supreme effort.

The range of the Prussian rifle did not permit the Guard to assist in preparing its own attack, in concert with the artillery; but our present rifle amply enables us to do so, and consequently we consider it a duty.

We do not pretend to originality; this idea of the preparation of the assault by infantry fire is not a novelty; the principle is clearly stated in the Regulations. Unfortunately, the Regulations are much neglected, and their suggestions little regarded.

Unfortunately also, in the French army, no attempt has been made since 1870 to develop the science of infantry fire, and to teach officers how to use it in battle. We are not speaking of target practice, which is the business of the soldier, in the limit of his eyesight, but of regulated, directed, controlled fire, which is the rational and necessary method of using a weapon with such range as our rifle now has.

Certain tacticians endeavor to solve this difficult question, the assault, by prescribing the use of formations more or less deep, more or less dense. In Russia a famous leader has offered this solution: "A continuous succession of lines of companies deployed in one rank, at greater or less distances from each other." In France, also, we have seen this proceeding upheld by the military press. The German army, in its latest manœuvres, showed us the assault delivered by troops similarly disposed, though, up to that time, it seemed to prefer the use of company columns in echelon.

It cannot be denied that there are advantages in the new formation thought out in the Russian army under the impression of the enormous losses suffered from infantry fire in its latest war, and brought into fashion at the grand manœuvres of the principal armies of Europe. But deeper and denser formations have their advantages too, while both, like all possible formations, have their defects. Without discussing them all in detail, we may say in general terms: *Dense formations increase the proportion of loss, but facilitate command and direction, while open formations diminish the proportion of loss, but render command much more difficult.*

It is difficult to choose between them; it is a question of situation, of ground, of moments, and especially of the quality of the troops to be led to the assault. It is clear that the better, the more solid, the better disciplined the troops are, the less necessary it is to group them and to hold them in the hand of the commander. If, on the contrary, the troops are young, little accustomed to war, and composed of less reliable elements, we should not think of scattering them and leaving them to

themselves, or of enfeebling the will and the direct influence of their chiefs.

At the end of the first Empire, conscripts were not led to battle as skirmishers like the veterans of Austerlitz, but formed in battalions in mass.

In our opinion, it is not in the use of such or such formations that we must seek the desired solution, and we think with Bronsart von Schellendorf that "premature attacks on an enemy insufficiently shaken throw a grave responsibility on the commander. Before giving the order for the assault, it will be his duty to take such measures that it will lead to victory and not to a bloody defeat. It cannot be left to the initiative of the firing line. It will have to be supported by fire up to the last moment. Sometimes the artillery, hindered by our troops, will not be able to support the attack; it then becomes the duty of the infantry remaining in rear to accompany and support the assault by its fire."

In a word, the success of the assault does not depend solely on the formation of the troops. It depends on other factors much more important, too, and the most important of which have heretofore been most regretably left in the background.

1. The first of these is artillery fire. We will not take time to explain its use and show its influence, for it will always assume on the battle-field the importance due to its power; but while we recognize the value of artillery, which, alone, can destroy material obstacles, clear away, and beat down the works of the defense, we do not hesitate to affirm that it does not suffice for the winning of battles. The statistics of recent wars show this clearly, for the proportion of losses due to artillery has never been more than 12 per cent.

In spite of this, the appearance of our manœuvres, which are supposed to present an image of war, tends more and more to become "*battle of artillery, assault of infantry.*" Little by little, the rôle of infantry at the beginning and during the development of the fight has diminished and disappeared, and we see in it now but one idea,—to pass as quickly as possible to the only act incumbent on it, according to our present idea,—the final assault.

It is easy to test this by comparing the number of blank cartridges issued to the infantry for the manœuvres with the number fired. The number left unconsumed shows that the infantry does not use its fire, that it thinks only of advancing to the assault.

We are committing in this a grave error for which we will pay dearly when war comes. We ought at once to give infantry fire the importance in our manœuvres which it will inevitably have in battle.

2. This is, in fact, the second factor of success in attack. It is the most important of them all, since it, alone, is capable of causing such losses as disorganize the enemy. In recent wars, the proportion of losses due to the rifle was 80, 85 or 90 per cent.

The rifle is therefore the principal agent of combat, and the best argument of victory.

It would follow, if we were logical, that the greatest part of the interest and study of officers of high rank should be given to infantry fire, in order

to learn its use and effects. It is strange this should be the one thing that occupies them least, if it occupies them at all. In reality it is not studied either theoretically or practically, and in our manœuvres the idea has never been mooted of according it any observation whatever, though for twenty years the question of fire has been the principal thought of the whole infantry arm. The infantry earnestly begs the means of training for battle, without the least response from those whose duty it is to provide for its instruction.

The thing our Regulations lack is not such or such formations; the less they give us of regulation types and diagrams, the better. The blank our infantry officers deplore has stood for twenty years, in consequence of the want of clear, precise, systematic and intelligent instruction in the use of infantry fire on the whole extent of the battle-field. There is nothing to indicate to commanders of sections, companies or battalions the sure and practical means of utilizing the powerful fire which they have in their hands, without knowing how to use it, from the opening of the battle, through all its phases, up to the final act which decides it.

This is the need which every one feels, and which every one understands more or less clearly; it will exist as long as it is not satisfied, and no so-called tactical invention, no new formation, no new method of manœuvring, however skillful, can remove it.

Enough of conferences on tactics, of dissertations and school theories on the art of war, of manuals and compilations; what we want is firing grounds and cartridges.

We are not in the confidence of those who elaborate the Regulations, but we can tell them that they will only follow another wrong road, and only arrive at another pitiful abortion, unless they decide at last to take as a guide the use of infantry fire during all the successive stages of the combat.

That these may be clearly understood we will explain them, following the course of the battle.

1st Phase.—At 3000 to 3500 metres from the enemy, the artillery comes into action and opens the fight. We think the infantry should precede the artillery, should gain ground in advance of the artillery positions, and should approach near enough to the enemy to harass him and force him to unmask his batteries. To this first service to its own artillery the infantry will immediately add another in thus approaching the enemy's batteries,—that of dividing their attention and injuring them with controlled rifle fire. It would be absurd to persist in reducing the rôle of infantry, even at the beginning of the action, to the duty of waiting, and to purposely renounce the advantage of its fire, as we have heretofore done, by halting them on a line with the artillery, or a few hundreds of metres in advance, and holding them there in long and painful idleness, until fortune has arranged events and decided the victory without the queen of battles.

No, it will no longer suffice for the infantry to serve as *support* for the artillery, that is, to leave it to struggle unaided with the artillery of the enemy; we want to help our batteries in this struggle, and make it easier and shorter. The power of our rifles now makes this an easy task, though

formerly the shorter range of our arms might perhaps excuse our inaction during the artillery duel;—an inaction bitterly regretted in 1870.

The infantry, then, should be eager to approach the enemy's batteries close enough to bring an efficacious fire on them. In the experiments at Chalons, a percentage of 4.8 was obtained on a battery at 1500 metres, or 48 hits for 1000 shots; it need hardly be said that this firing was by volleys, regulated and controlled by the officers. This is a result not to be neglected.

Doubtless the enemy's infantry, animated by the same spirit as ours, will seek to gain ground enough in advance of its guns to protect them efficiently and to keep our artillery at a distance. It follows that an infantry combat will be added to the artillery duel. This first consequence of our plan may not suit routine ideas, but that is no sufficient reason for rejecting it, since if we persist in rejecting the help of our infantry in the phase of the battle too narrowly defined as the artillery fight, the enemy will not hesitate to accept it, and to draw from it all the advantage possible; and the only result will be a grave inferiority in our artillery from the beginning of the engagement.

But if we grant that it is the province of our infantry to advance well beyond our artillery, it follows, from the similar intention which we attribute to the defender, that our infantry must be strong enough to hold its advanced positions, and also to suffice for its mission of active protection to its artillery: during the first phase, it will have only this duty.

Its rôle may be summed up thus:—to cover its artillery and fire on that of the enemy; that is to keep the enemy's infantry beyond efficacious range of its own artillery and, in spite of the opposing infantry, to hold its ground within efficacious range of the enemy's artillery.

This first phase will be long. The expenditure of ammunition will not however be excessive, for the infantry will use, during this phase, only slow, regular, controlled volleys. Moreover, the supplying of ammunition has not yet become very difficult.

2d Phase.—During the first phase, the commander will be enabled to judge of the situation and to decide whether he will pursue the fight or break it off.

In the first and more usual case, he indicates the principal objectives and the distribution of the troops among them. Now, what are the different duties to be distributed, in view of the end proposed for the efforts of all?

(a) First of all, to push on and gain ground little by little to the front, by taking successive intermediate objectives, nearer and nearer to the principal objective assigned. Such an advance can be made only by the help of fire and of partial assaults; for we cannot suppose that things will happen here as they do in our grand manœuvres, where the various units may be seen to set off from 1000, 1500, 1800 metres or more from the position, and march directly on it, without firing a shot and in the twinkling of an eye. On the battle-field ground must be gained slowly and laboriously, by seizing at each step some of the enemy's points of support, clumps of woods, farm-houses, hedges, ditches, etc., which will be found occupied and warmly disputed, and which must be taken at the cost of serious efforts and sacrifices.

Each of these successive efforts will constitute a partial combat, with its

skirmishers, supports and reserves; we need each time the help of efficacious fire, the advance and the shock on those points where the enemy's resistance is strongest.

The distribution, then, will logically be made thus:

1st, the firing line;

2d, partial reserves, successively engaged, according to the importance of the points to be seized; either company, battalion, brigade or division reserves, and still further in rear, at the disposal of the commander alone, the corps and army reserves.

The successive and opportune support of these different reserves will enable us to drive the enemy from point to point, from defense to defense, until finally we hold him fixed, limited, tied to his principal position, now clearly defined.

While the portion of the troops energetically engaged wherever they can find a foothold are performing this long and arduous task, there will be a multitude of small affairs, more or less interconnected, which all converge towards the same end and all taken together form one whole,—the battle. These different affairs will not take place on the same regular line: courage and good fortune aiding or lacking, some will gain ground, others will remain stationary. There will be along the front of battle salients and reentrants, bastions and curtains; at some places, the attackers are just preparing by their fire for the assault on their objectives; in others, they are preparing the first points, already seized, for defense, to serve as support in their movement on a new objective. But at the same time, all the combatants keep their attention on the ultimate object, *the principal position*, where the enemy concentrates the means of resistance, and as soon as any one appears there, they should fire on it by volleys. *Thus, by the support of infantry fire in the artillery fight, the resistance of the enemy is progressively weakened from the beginning of the action, and the assault is finally made possible.*

In our grand manœuvres all the assaults appear unnatural, because the defender remains intact, enduring the most intense fire, from the beginning of the affair, without the least loss. If on each occasion a number were withdrawn (based on the data of the school of fire) corresponding to the probable loss due to the skill with which the fire of the attack had been conducted and the time it had lasted, we could doubtless see in most cases that the assault had more prospect of success than is generally believed. *We must find the means to provide umpires of fire in the manœuvres.*

3d Phase.—The phase we have just discussed does not extend to the decisive act. The troops engaged in this phase, whom we may call "troops of fire," will have fulfilled their mission when they have fixed and defined the defender's position of resistance and obliged him to bring the greater part of his reserves into action; when, in a word, they have exhausted the preliminary defense.

In that mission, as we have seen, they must employ volleys, because in that portion of the battle-field where they act, they are at such a distance from the enemy that the individual firer cannot clearly see an object to aim at: the officer alone can distinguish, frequently through the field-glass, the

position and movements of the defender. He alone, therefore, can assign objectives to aim at, and thereby direct the fire. At such distances, the officer must be master of the firing, which he will cause to begin and to cease at his will: there can be no question of any but controlled fire; individual fire would be, there more than anywhere else, an absurd waste of ammunition. Later, when the defender's line can be clearly seen, we may consider the advisability of passing to individual fire.

But to be used opportunely and to produce all their useful effect, these volleys must be an object of careful, theoretical and practical study for the officer, for their value intimately depends on the ground, the distance, etc., all conditions which the soldier is not capable of taking into account, and which the officer alone can be enabled, *by sufficient study*, to appreciate and understand.

Up to this time in the French army, we have neglected even to outline this part of an officer's practical instruction, who, on account of this omission, finds himself, as far as the fire of war is concerned, much behind his comrades of foreign armies.

To return to our examination of the phase we have just discussed. Since, while it lasts, the only object is to crowd the defender back to his position and fix him there, we may ask: "When will this phase end? At what moment will the troops charged with this duty have finished their work?" In our opinion, we must seek the answer in the study of fire. These troops will not have finished their work as combatants until the victory is gained, but they must stop their advance when they reach the points from which the rifle produces its maximum effect. This follows from their special duty as "*troops of fire.*"

It is difficult to understand the efforts made to define the point from which the assault is to be launched, or why it is fixed at such or such distances. Evidently it should be as near as possible to the enemy. But in the phase we are discussing there is not yet any question of the assault. The only problem before us for the moment is this: to approach the enemy until we can obtain the superiority of fire, or (what amounts to the same thing) to advance to those points whence we can inflict the greatest loss possible on the enemy. Until we have broken by fire the vigor of his resistance, there is no use thinking of the shock.

What are the points whence the rifle can do the most harm to the defender? Why is it said that the assault must start at 500 or 600 metres distance? Are these distances calculated or given at random?

Without writing a long treatise on fire, we will confine ourselves to the following explanation:

Suppose the defender established on a relief overlooking the surround-

FIG. I.

ing ground: this is usually the case with the party reduced to the defensive. Fig. 1 shows that volleys at long range will have a plunging direction, and consequently, little useful effect, while those at short range (Fig. 2) will of

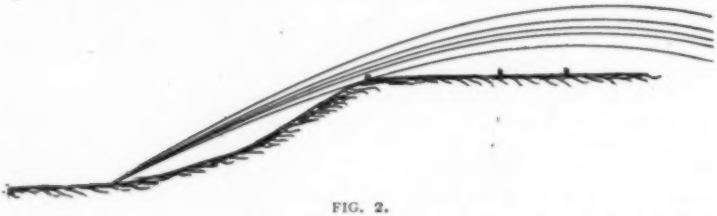

FIG. 2.

necessity have an eccentric trajectory, rising well above the plateau: they pass in the air over the defenders' heads. The only efficacious fire is that whose trajectory will have a rise (Fig. 3) nearly equal to the difference of level between the position of the firers and the summit of the relief.

FIG. 3.

Naturally, at the beginning of the fight we must use long range fire since we want to utilize the long range of the rifle; the results we obtain will at least be better than inaction. But we have no object, while the fire fight lasts, in approaching too near to the enemy's position, for this would diminish the effect of our fire. Besides, our artillery, established behind us is in a position to cover with its fire the approaches of the position and we should hinder this fire by advancing.

Now let us see, according to the experiments of the school of musketry, what are the ranges which offer most advantages. The horizontal distance of 500 metres corresponds nearly, in the theoretical trajectory of the rifle of '86, to an elevation of 8 metres; 600 metres corresponds to an elevation of 10 metres; 800, to 30 metres, etc.

It follows that these distances vary with the elevation of the enemy's position; the greater this elevation, the less we should approach the foot of the slope during the fire fight.

This principle is understood by children, for they do not stand at the foot of the wall to throw a stone on the roof, but at some distance. We must teach its application to infantry officers, in order that its practice may become familiar to them in the manœuvres, and later, in battle.

As the defender's position and the ground of the attack will present a great variety of undulations, which will modify according to the positions occupied, the relation between the range and the difference of level, the union of these points, that is, the front of the fire fight (Fig. 4) becomes an

irregular broken line more or less near the enemy, according to the configuration of the ground.

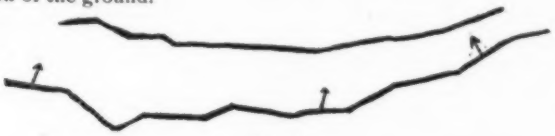

FIG. 4.

The troops engaged in the fire fight along the whole front will establish themselves on this line, sheltering themselves as much as possible, in order to avoid any danger of repulse, and, constantly reinforced by new units brought up into the intervals, they will keep up a strong and well-directed fire on the position until the enemy's fire weakens.

The firing line thus formed will be very extended. An army of four corps, one in general reserve, with 3000 metres front for each corps, would occupy 9000 metres at least.

On such a front a number of varying incidents will necessarily occur, attacks on points of support, offensive returns, etc., the result of which will be the dissolving and mixing of units, such as we have always seen in battle.

In reading the "History of the Campaign of 1870," by the Prussian general staff, or the Memoirs of Marshal Von Moltke, we find at every instant this disorder; units mixed together, and incapable, in this state, of any immediate new effort: they were always obliged to stop and reform, before the commander could use them again.

But while these accumulations occur on some points, elsewhere there are only thin lines, too weak for shock action, but powerful by their fire; in short, the troops who form the front of battle at this time can still use their rifles, with effect, but they are incapable of a vigorous forward movement.

Can we think seriously of sending them to the assault in this condition, along a front to which, by our hypothesis, we have given a minimum extent of 9000 metres? Is it not evident also that the enemy is still concealing his game, and that he still has strong reserves, that, in a word, he is still able to oppose a formidable resistance to this immense line, entangled, confused and wearied by the long and arduous work just accomplished? It would be madness to send them to the assault.

Furthermore, in a great battle we cannot rely on the will and audacity of a brave and determined subordinate, or on chance, for a favorable result: it is the duty of the commander-in-chief to seek and prepare it, providing all the chances of success. He will certainly not think of confiding the decisive act to this long, weak line of fire, broken into many portions, or massed in confused bunches on intermediate positions.

It is the business of division and brigade commanders to establish the direction and hold their troops on the assigned objectives; they must also be enabled to support the various minor actions by the free disposal of their partial reserves. These reserves should be as numerous as possible and be kept intact until they are really needed; this is the only means to watch the course of events and profit by them, instead of being at their mercy.

4th Phase.—No one, we think, even among the bitterest partisans of thin

lines, dreams that an assault can succeed along this front of 9 kilometres. The troops there are no longer capable of the necessary effort, while for firing their situation is, on the contrary, very good. In fact they hold the enemy under their rifles, and it would be very imprudent to renounce this advantage for the sake of attempting the impossible.

They will not, therefore, attempt the assault; which does not imply that they will not contribute to this crowning act of the battle, but that it is not their province to give the signal, or to play the principal part.

The commander-in-chief, watching the course of events, selects the points where he wishes to bring about the final solution; it is his province to choose the point of assault. The end in view, the ground, the facilities for approach, the condition of the enemy, are the principal considerations which influence his decision.

These points once chosen and clearly indicated, the reserves designated for the assault will be brought up as close as possible, under cover of vigorous fire from the whole line, and when these troops have reached their position the various scenes of the final act will follow in rapid succession.

During the wars of the first Empire, solutions were simpler. The battle began at short ranges, the dispositions of the enemy were sooner seen, his movements were visible, the decision of the commander was prompt and its execution like the thunderbolt. Senarmont or Drouot brought their guns at the gallop to the point selected; massing their batteries they made an opening in the enemy's front, and into this opening plunged the infantry columns of Mouton, Ney, Lannes or McDonald, the torrent of cavalry of Lassalle, Rapp or Hautpoul. The action, though inspired by the genius of war, was comparatively simple. The general engagement at short range gave the oppartunity to bring up quickly and without excessive loss, the masses of cannon, bayonets and sabres which struck the deciding blow.

The power of modern arms has not in the least changed the principles of war, but it has made their execution more difficult; for our masses are much further away, and we cannot bring them up without great risk.

Hence the military writers are seeking and proposing the means which seem to them to solve this difficult problem. Permit us to state our solution.

As we have already said, when the combat reaches its full intensity the enemy, reduced from choice or necessity to the defensive, is awaiting the blow which he feels to be imminent; he is on the watch from his position, and it is comparatively easy for him to bring up his reserves and to conceal his plans of resistance and counter-attack. He watches with care for indications of the assault and the appearance of the troops which are to deliver it, in order to rise suddenly in front of them and crush them with the fire of his artillery and infantry, while they are traversing the 500 or 600 metres which the assailant must cross. It would certainly be clumsy of the assailant to play the defender's game, and to expose many troops on a wide front to the terrible hail which awaits them.

Yet in the manœuvres do we not constantly see the assaulting troops start from a long distance and calmly cross great open spaces, quite at their ease under the most terrible fire? They are sure of arriving without losing

a drop of blood, at the position, the defender of which is, from the first sure to be conquered, in spite of the fire which he pours on the rash aggressor.

This splendid spectacle always delights the spectators, who look for it with impatience and applaud it with enthusiasm. But those who direct or tolerate it are culpable; they commit a great fault and incur the bloodiest responsibility; for the manœuvres should not be a scene in a play, but a school of war, a season of practical instruction in battle and its means, for the troops who will necessarily apply, when opposed to the enemy, the lessons they have been taught in peace.

The manœuvres are not designed to give birth to dangerous practices, to mislead the mind and to stifle the intelligence.

Now since it is evident that in the terrible reality of battle the assault cannot be delivered as it is in our manœuvres, that it can never begin at such distances without being condemned to the most certain failure, we ought to teach the lesson of the assault differently, and to divide it into several acts, intimately bound together, however, by the determination to succeed.

1st. First, to bring up, as under the first Empire, powerful batteries to induce the defender to bring his reserve artillery into action, to force him to show his hand, at the same time ourselves keeping a reserve of batteries immediately available.

2d. To throw forward, not on the whole line, but on certain points, small bodies of infantry, kept in reserve up to that time, vigorously led with orders to pass the firing line and gain ground in advance of it.

This movement will act as a decoy: it will probably lead the enemy to leave his cover and show where he is in force, in expectation and uncertainty of the intentions of the assailant.

Our firing line will then render us the greatest service, for the adversary's line, defiladed till then, will be defined and profiled before it, like silhouettes and targets exposed to the most advantageous fire.

Here individual fire will have its whole application and full efficacy. On the firing line of the attack, each man, sheltered, rested and in some degree calmed by waiting, will see before his rifle, at easy range, a crowd of targets, among which he has only to choose.

Naturally, the fractions sent forward to induce the enemy to show himself, however resolute they may be, will not carry the position by themselves. Their energy will soon be exhausted; they must stop, hold on to the ground they have been able to reach, and thence take part in the fire fight which their audacity will have rekindled in all its fury.

Hence the troops sent forward must be in bodies of little depth and easy deployment. In our opinion, the company column answers these conditions best, but we do not make a point of any formation; we only insist on the idea and the fact,—to gain ground by pushing forward small bodies from the reserve.

As a matter of course, the ground thus gained must be held, and this must be assured by a forward movement of the whole line which will in its turn advance as soon as possible to the points reached by the partial as

saults. The reserves will also follow the movement and draw nearer, utilizing all available cover.

This first scene of the final act, as we have described it, is not merely a mental conjecture; it has already some little authority from experience on the modest ground of the manœuvres where we have seen it practised. The effect produced was striking, in spite of the difficulty always imported into the observation of the enemy's acts by the crowding of civilian spectators on the defensive position. We could see that as soon as the two or three companies thus suddenly sent forward by the attack passed the firing line, the whole front of the defense, till then entirely invisible, rose on the slopes and crest of the position and exposed themselves from all directions to an easy and efficacious fire.

We are convinced that the same thing might be done on a real battlefield, and that the same result would be repeated at different points, in such a way as to gain some ground to the front each time. In fact as soon as the first feint of assault has been brought to halt, after inducing the defender to expose himself to the short range fire of the attack, other companies or battalions will move forward in the same manner and with the same success. The defender at the first and at the succeeding alarms will naturally see in these partial but vigorous advances only the prelude to the assault he is awaiting, and each time his imagination will increase the number and strength of the advancing bodies.

Does this idea spring from our imagination, or can it be supported by facts?

We read in the "History of the War of 1870" (German Staff—battle of Noisseville, attack on the brewery):

"Suddenly thick lines of skirmishers rise from the hollow between Montoy and the brewery, on the left flank of the position, and rush on the buildings south of the road."

These "thick lines" were simply three small columns of companies, connected by their first sections deployed as skirmishers, the whole forming one battalion. The effect was complete and the brewery was taken.

After each bound as we have said, the front of the attack will advance to the limit of the ground gained, a limit marked by the troops sent forward halted as soon as their energy is exhausted and immediately engaged in a fire fight, under cover of which the neighboring portions of the firing line left in rear can advance.

The distance between the adversaries is thus little by little diminished; the assailant has succeeded in crossing, without losing all his men, the greater portion of that formidable zone of death where the defender confidently expected to destroy him.

From place of arms to place of arms, from parallel to parallel, the assailant has advanced, so to speak, to the foot of the scarp, vigorously supported on the way by strong batteries in rear and by the firing line; the reserves whose shock is to finish the battle and give the victory have only a short distance to cross at a single bound.

Thus from beginning to end of this act, the fire of the rifle will be constantly ready to prepare and sustain the advance and to assist in holding the positions seized.

It is often said that future battles will last several days; this seems probable on the very reasonable hypothesis that intrenchments will play a more important part than ever, and that the operations of a battle will thereby acquire a certain likeness to those of a siege. The terms "places of arms" and "parallels" will in that case be all the more correct, and, as in a siege, we will see the assailant fortify and prepare for defense the successive positions gained in the approach, in order to move forward again under the protection of his artillery and infantry fire, until he is at last able to make a breach and storm the position.

We are profoundly convinced that the firing line cannot give the shock, for it has neither cohesion nor impetus; moreover the fight will have greatly tried it already and cost it many of its leaders, and those who are left will no longer have the power to electrify the long firing line, broken into innumerable fragments where several units are intermingled.

At this moment of the fight, in order to pull down the balance, we must throw in strong reserves to finish the work of fire by their sudden intervention. We cannot conquer without striking, and to strike we want a hammer. We must have masses whose special duty it is to give the shock. These troops are destined, not to maintain the fight with their fire, but to end it by marching straight on the enemy. This is the business of the army reserves, and of whatever is left of the corps reserves.

What formation should they take? We say without hesitation that we do not care. We want them to be numerous, to come up united and vigorous, to follow each other promptly and support each other resolutely, to crush all opposition by their violent shock, and to lead the whole army by their example to drive off and pursue the enemy.

That is all we ask; grant that, and we do not care whether the troops who give the shock are in close columns or open columns. However, we think the company column preferable to battalions in mass. But above all we want the general who commands the assaulting troops left entirely free to take the formation he thinks best suited to the ground and the circumstances. An able leader will always know how to choose, "while not even a stereotype," as Bronsart Von Schellendorf well says, "can make stupidity succeed."

To sum up and state our conclusions; we think them entirely in harmony with what will happen in the next war, and indeed, except in some small details, with what has always happened.

Thus we say that it is useless to change the Regulations again, for they give us all the formations we can need, skirmishers, lines, columns of all depths and all densities. It is the officers' business to select and use the different formations according to the end in view, the ground, time, etc.

All diagrams, all stereotypes, serve only to fetter and stifle the will and the intelligence. What we need is the determination to conquer, ardor for combat, energy of thought and action and freedom of movement; not a "scheme" to learn by rote.

How much has been written on this head! How many curses have been pronounced against formula! How many times has it been judged and condemned by great soldiers of every age and all nations, and cruelly denounced

by events themselves! And yet it ever springs up and reappears. We will see it still, an incubus on our manœuvres, stifling our efforts and wearying our minds, until a sure and clear direction comes from the head of the army; until each corps ceases to be a little church in which the priest can substitute his personal lucubrations for the Regulations.

The difficulty is not in making Regulations; the head of the army has plenty of tools for that work. But to procure them respect and obedience is another affair, and the authority of the commander-in-chief will be complete only when he puts a stop to the encroachment of the holders of high command on the rights, and even on the duties of the subordinate officers placed under their orders: only when he enforces respect from all for the Regulations.

The less the Regulations are altered the better. They are sufficient for all the needs of the battle-field; in fact they are rather too voluminous, and their fault is a tendency to go too much into detail.

"The complication of Regulations," says Bronsart Von Schellendorf, "leads to contempt for those Regulations, too numerous and confused to be known. Excess of regulation teaches all to neglect them; the most conscientious cannot obey them; that most precious quality, *regularity*, is transformed into an insupportable defect; it completely annihilates the initiative and the dash of the different lines, to substitute routine and habit, reducing command and direction to the application of stereotypes and diagrams, which in the usual case cannot be adapted to varying circumstances."

Entirely agreeing with the German general on this question, we ask that the Regulations may be reduced in bulk, to suit the short service of our soldiers; but then that they be known and observed from the top to the bottom of the military hierarchy, and no longer replaced by individual inventions, or even by systems already condemned by the experience of war.

Now if we are asked whether, in our opinion, the Regulations indicate to our officers all they need know, in order to obtain from their troops and their rifles the best results in battle, we answer no. We have for a long time seen in them a deplorable blank which must be filled; we refer to the instruction of infantry officers in the control and direction of fire during the whole of the long battle whose phases we have described. There is nothing to give the officer that clear and correct knowledge, which is now indispensable, of the value of fire and the best method of using it.

Up to this time the ignorance of our officers in this matter has been, so to speak, absolute, for their instruction in fire has been strictly reduced, like that of the soldier, to the narrow idea of individual fire. It said and repeated in high places and in the schools, that the individual instruction of the firer on restricted firing grounds was everything. They have never been told of anything but the isolated shot, for no correct idea has been introduced into the rules for collective fire of its direction and control by the officer who commands it. It follows that, though armed with a rifle of more than 2000 metres range, our infantry does not know how to use it beyond 600 metres.

It is evident that beyond 700, or 800 metres at most, individual fire loses

all value, since at these distances the eye of the firer cannot clearly see an object to aim at. Only collective fire, directed by an officer provided with map and field-glasses can be useful; but how without ever learning it, can the officer use the veritable engine of war which the section, the squad or the company ought to be in his hands?

As the officer of artillery directs the fire of his battery of field guns, the officer of infantry to-day ought to know how to direct the fire of his battery of rifles.

Now, everything is yet to be done in this direction, and as a beginning, the Regulations for combat should give, in their first pages, a programme of instruction in fire, first theoretical, then practical, comprising a series of observations and exercises, all very simple and clear and carefully freed from mathematical formulas, which are incomprehensible to most, and tedious to all.

These exercises may be reduced in principle to the same study, which will vary according to the configuration of the ground on which it is to be applied. It may be thus stated: "Having given an objective, to start from the limit of rifle range and advance over the ground which separates you from that objective, making a halt every 50 or 100 metres. At each of these halts, to consider the effects of fire on the objective and the method of directing this fire so as to obtain the maximum effect." This study would at first be purely theoretical; it would then be made practical, by firing from the different halts on various formations represented by targets, in line with the objective, in front or in rear of it.

The theoretical portion could be studied anywhere, if the War Department would only direct the publication of the experiments at the school of musketry, the results of which have as yet been kept secret,—nobody knows why.

As for the practical instruction, it cannot be given on the short and narrow strips of land dignified by the pompous title of firing grounds. Our infantry cannot learn the use of the rifle until they are given spacious and varied grounds where the regiments may go for instruction in the fire of battle. If it is necessary,—if the Treasury can afford nothing better,—let each infantry division in succession occupy the few firing grounds where they may fire as they would fire in war.

Finally it is indispensable that in all manœuvres of combat, and especially in the grand manœuvres, there should hereafter be a serious and competent arbitrage of fire. We may say that as long as this arbitrage is lacking as it is now, our manœuvres will do little good as a preparation for battle.

For twenty years we have upheld the opinion stated in the foregoing lines, but we know that our humble voice has not reached the lofty regions where the command of the army soars. Must we thence conclude that we are in error? It is for the reader to judge. Perhaps he will share our view on some points, or of the general aspect of the question we have endeavored to make clear; if so, we shall find in this first success a pledge of hope for the future.

It is said that fifty years are needed in our country for the making of the least progress, so strong is our love for routine and our dread of change,

even the most beneficial; this leaves still thirty years of patience for those who would like to see some progress in the realization of our ideas.

In any case, may the God of battles inspire us at last with energy, determination to conquer, warlike intelligence and soldierly spirit, and save us from ignorance, indecision and confusion, the gloomy heralds of defeat and disaster!

AERIAL NAVIGATION.*

By O. CHANUTE, C. E., of Chicago.

(By permission.)

PART II.—AVIATION.

HAVING sketched what has thus far been accomplished with, and what may be fairly expected from navigable balloons, we may next turn our attention to that other class of students who call themselves "Aviators," and who, discarding the use of a gas-bag, seek to solve the problem of flight by purely mechanical means. They point to the birds in confirmation of their views, and constitute by far the most numerous as well as the most ancient school; for, to say nothing of ancient traditions, earnest proposals have been brought forward during the last 400 years to compass flight by various mechanical contrivances.

With these students, the possibility of success has been more a matter of faith, of instinctive belief, than of sober calculation. They watched the birds, saw that they progressed through the air by mechanical action and skill, and were very much heavier, bulk for bulk, than the air which their bodies displaced (for we may dismiss with a smile the old time assertion that birds gain levity by inflating their quills with heated air), and they hoped that man might accomplish similar results by somewhat similar means.

Impressed with these views, a number of these students have organized aeronautical societies in Great Britain, in France, and in Germany, and have for the past twenty odd years been reading papers, discussing the subject, and trying sundry experiments.

Very little practically has thus far come from these efforts, for curiously enough, and yet naturally, the first endeavors were to devise or to construct models, which have remained toys, before knowing accurately the resistances and conditions which they were to encounter in the air. In other words, the work began upon the constructive instead of the analytical features of the case, as usually happens at the outset of an invention, and while a good deal of valuable information has been gatherered, no practical machine has yet resulted. Some theoretical investigations have been attempted, but unfortunately the scientists have been hopelessly at variance not only among themselves, but also, what is more important, with some of the ascertained facts.

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* A lecture delivered at Cornell University in 1890 and published by *The Railroad and Engineering Journal*, by whose courtesy the plates are furnished.

Thus it has been so far unknown what power birds expend in overcoming the resistance of the air in their flight, or what amount of support they derive from it at various angles; and although the laws of fluid resistances laid down by Newton are known to be erroneous, they are still taught in the academies; and it was only the past summer that a new theory of flight, which may prove to be the correct one, was proposed simultaneously by two civil engineers at the Aeronautical Congress of the Paris Exposition.

Even the theory of the equilibrium of the common kite, supposed to have been invented by Archytas 400 years B. C., is still a subject of dispute, and every little while a fresh solution of its numerical reactions is proposed by a mathematician.

Possibly, in consequence of this state of uncertainty as to the laws of

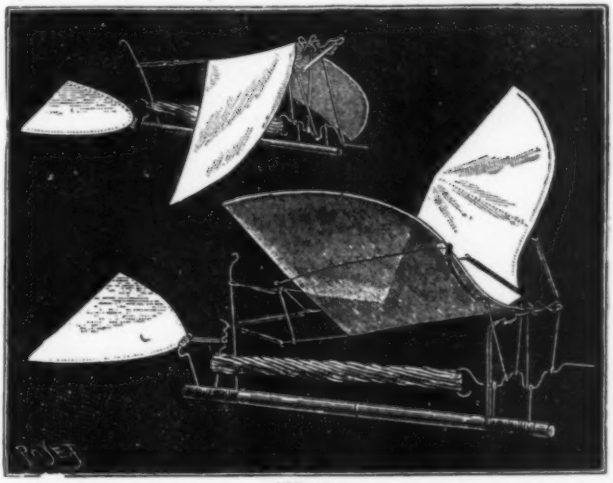

FIG. 5.

flight, the Aviators have been divided into three camps or sub-schools, which have looked for success from somewhat different contrivances, and who have advocated the following mechanical means:

1. The imitation of the flapping action of the wings of birds.

2. The sustaining of weight and obtaining progress simultaneously through the air by horizontal screws.

3. The sustaining of weight by fixed aeroplanes, and the obtaining progress by means of screws.

A great many experiments have been tried and a great deal of ingenuity has been expended in each of these three directions, but thus far not a machine has been able to leave the ground with its prime motor, and what measure of success has been attained can only be exhibited through toys, which give an idea of the principles involved.

The advocates of wing action hold that nature cannot err in her methods, and that success is only to be achieved by imitating her; they have

therefore endeavored to devise moving surfaces which shall repeat the complicated movements of the wings of birds, so as simultaneously to sustain and propel the apparatus. The only motive power which it has thus far been found practicable to use has been the torsion of india-rubber, and with this a number of clever mechanical birds have been contrived by Mr. Brearey in England, and by MM. Penaud, Tatin, de Villeneuve and Pichancourt in France.

The latter—that of Pichancourt—dates only from last summer, and is represented by Fig. 5.

It measures about 12 in. from tip to tip of wings, and weighs 385 grains, one-third of which consists in the twisted rubber strings furnishing the motive power. The necessary flexion of the wings, to obtain a propelling as well as a sustaining reaction, is produced by a triple eccentric, each actuating a lever fastened to a different point in the wings.

Upon being wound up and released, the apparatus flies slightly upward, and to a distance of 30 to 60 ft., in from 3 to 6 seconds. Similar but larger birds, of the same make, are said to have flown up to a height of 25 ft. and a distance of 70 ft. against a slightly adverse wind.

The relative power absorbed, however, is quite beyond the capacity of any known prime motor.

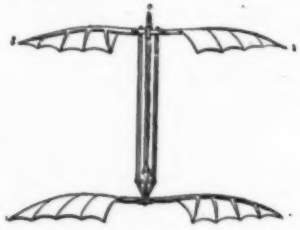

FIG. 6.

The next principle—that of an aerial screw to sustain and to propel simultaneously by its horizontal revolution — was actively promoted in France some 25 years ago, and great results were expected. It was proved, however, that it required about 1 H. P. to sustain 33 lbs. in the air, or much more than the energy of any engine, and the sole survivors of the many experiments made are the various flying screws which still amuse children; the best of these being that of Penaud, shown in Fig. 6, in which two screws rotate in opposite directions and cause the apparatus to rise or to fly in a circle, according to the proportions of its various parts.

And lastly, in recent years, experiments have been made with combinations of fixed surfaces, called aeroplanes, to sustain the weight, and of rotating vertical screws to propel. Machines or models on this principle have been built by Henson, Stringfellow and Moy in Great Britain, and by Penaud, Tatin, de Louvrié, and du Temple in France, but thus far not one has succeeded in lifting a self-contained motor and perhaps, after all, the best example of this class of contrivance is the artificial butterfly of M. Dandrieux, which is shown in Fig. 7.

The flight of all these toys lasts but a few seconds, and none of them carries its own motive power, while it will be found by measuring accurately the foot-pounds expended, and the weights sustained in a given time, that not one of the prime movers known is as yet sufficiently light, in proportion to its energy, to furnish the power required to maintain them in the air.

FIG. 7.

This question of motive power, the vital one in Aerial Navigation, will be discussed more particularly hereafter, but it may here be mentioned that a few observers, who have been watching birds soar without flapping their wings in southern latitudes, believe that this species of flight involves no expenditure of power whatever, save for the getting under way. This opinion has been much ridiculed, but yet it is possible that if we take into account the force of the wind, the belief of these observers that certain birds can soar indefinitely at moderate speeds without other exertion than the passive one of keeping the wings rigidly extended may not be as absurd as at first sight appears; but if man is ever to direct himself at will through the air, at satisfactory velocities, he will need power, and plenty of it; more indeed in proportion to the weight of the motor and of its supplies than he has yet been able to devise.

Meanwhile a few observers and scientists have been patiently investigating the motions which birds perform in their flight. Among these may be mentioned the Duke of Argyle and his book, "The Reign of Law"; M. Mouillard and his "Empire de l'Air"; Dr. Petigrew and his book on "Animal Locomotion," and especially Professor Marey, who has just published a book, "Le Vol des Oiseaux," the result of 20 years' investigation, which is most interesting and valuable, but which, unfortunately, throws but little light upon the all-important questions as to the sustaining reactions to be derived from the air, and the power required for flight; the latter having remained in controversy since the days when Navier made the erroneous

calculation that a flying swallow exerted one-seventeenth of a H. P., or at the rate of no less than 3586 H. P. per ton of weight.

Of course, the first thing to ascertain is to know what are the components of air pressure upon a plane in motion at a given velocity, if inclined to the current. In other words, what proportion of the usual right angle pressure remains if the plane be tilted, and how much of this new pressure acts as a sustaining force or *lift*, while how much opposes forward progress, and may be denominated *drift*. Some interesting experiments have been made in Great Britain on this subject, and more of them in France, but they have chiefly been made with some form of rotating apparatus, and it was found not only that the results obtained with direct currents did not agree with those of rotary machines, but that the latter showed greater pressures on planes inclined at angles of 50° to 70° than on those placed at right angles to the current (a most improbable condition), so that it is now believed that the centrifugal force of the rotating vanes in some way vitiates the results, and the French have been preparing to try a new set of experiments upon artificial currents to be produced by large ventilating fan

Things were in this condition when an International Congress of Aeronauts and Aviators was held in Paris last August. During this a number of papers were presented, and among them were two which may lead hereafter to a new and more rational theory of flight. One was by a Russian engineer, M. Drzewieki, who, starting from the best empirical formulæ he could find, had calculated the weights sustained, the surfaces required, and the power needed for aeroplanes in artificial flight at various velocities, while the second paper was a theoretical investigation of the same subject by the present lecturer.

The remarkable result about these papers was that, starting from two different standpoints—the empirical and the theoretical—they closely agreed in their conclusions; and as the paper of M. Drzewieki was the most complete and thoroughly worked out, I shall prefer to give an account of it rather than of my own.

M. Drzewieki first showed that the hitherto received idea that a bird in flapping his wings generated thereby a sufficient pressure to sustain his weight is incorrect. It has long been known that the pressures experimentally obtained by striking the air with surfaces of equal area and velocity with those of the wings of a bird, or even with the wings of a dead bird dried and mounted in an apparatus, do not generate a sustaining reaction equal to the weight of the bird; but it was dimly believed that the living bird had the skill, in some mysterious way, of obtaining from his strokes sufficient intensity of pressure to sustain his weight. M. Drzewieki says that this view is quite erroneous, and that the bird is really sustained by the vertical component of the pressure due to his speed. In other words, that the flying animal is really an aeroplane, whose body and wings in all stages of their action make a very small angle with the impinging air, and that the propelling power is chiefly derived from the rear thrust exerted by the escaping air against the outer curved extremity of the quill feathers.

Moreover, if account be taken of the forward motion, the angle which the wings present to the line of flight must be less than 6°. It is impossible

to detect this angle of incidence by the eye. The wing seems to be flapped vertically downward; or in soaring the bird seems to hold his wings and body absolutely horizontal; but in point of fact we know that there must be an angle of incidence in order to obtain a sustaining reaction. This brings up the inquiry as to what that angle really is.

M. Drzewieki starts from Duchemin's empirical formula of the normal resistance which air opposes to an inclined plane moving against it, and deduces therefrom the sustaining reactions per square meter at various velocities for various angles from 20° to 10°, and these are tabulated for ready reference. Next he calculates the horizontal components of the normal pressure for the same velocities and angles, this being the resistance to the advancement of the plane alone, and to this is added the head resistance due to the thickness necessary to secure the required strength of the plane, or in other words, its hull resistance, and to this again is added the probable friction of the air against the sides. These three items together give the total resistance to forward motion, and are also tabulated for ready reference.

Then, by combining these two tables and plotting the resulting curves, in order to ascertain at what angle there is a minimum of resistance to forward motion, while yet retaining a sufficiency of sustaining power, it is found that this occurs for one and the same angle at all velocities, this being 1° 50′ 45″, and this M. Drzewieki assumes as the angle of flight.

I may here mention that these two reactions, or components of the normal pressure due to the angle of incidence and to the speed, formed the subject of the paper read by myself at the Paris Congress, and of a similar paper which I presented before the American Association for the Advancement of Science at its last meeting, and that I had reached the conclusion that the most favorable angle for soaring was between 1° and 2°.

Assuming 1° 50′ 45″ as the angle of flight, and allowing for the vertical and horizontal components of the normal pressure due to the speed at that angle, as well as for the hull resistance and friction, M. Drzewieki then gives four formulæ, supplemented by tables, which produce the following elements:

1. The weights per square meter, which can be sustained at this angle of 1° 50′ 45″ at various speeds.

2. The work done (kilogrammeters) to overcome the forward resistances under the same circumstances as above.

3. The proportion of the work done to the weight sustained.

4. The amount of surface required to sustain 1 kilogramme at various velocities.

The consequences which M. Drzewieki deduces from these formulæ and the plotting of their curves are the following:

1. An aeroplane progressing horizontally, with the angle of incidence (1° 50′ 45″) corresponding with the minimum of work, meets practically the same resistance at all speeds, so that the work done is approximately a function of the weight of the apparatus, multiplied by the velocity.

2. Aeroplanes designed for small speeds need relatively large surfaces and small weight; these conditions he believes to be difficult of realization in practice.

3. The greater the speed, the less surface needed to support a given weight.

4. The less the surface, and therefore the greater need of speed, the greater must be the motive power.

These conclusions are believed to be approximately sound, and M. Drzewieki sustains them by showing that in flying birds the smaller is the sustaining surface in proportion to their weight, the greater is their customary speed, giving a table of the proportions of some 64 birds, which shows that the surfaces of the body and extended wings range from 7.56 sq. ft. to the pound for the bat, which flies at the rate of about 20 miles per hour, to 0.43 sq. ft. per pound for the male duck, who progresses at about 60 miles per hour. He estimates that for a speed of 90 miles per hour, the surface required will be but 0.22 sq. ft. to sustain a pound of weight.

It seems to follow as a conclusion that if aeroplanes are ever built to carry tons of weight, their proportion of surface to weight may be considerably less than those which obtain with birds, but that the speed will need to be greater than that of flying animals in order to obtain support from the air, while the motive power required will vary approximately only in the direct proportion of the weight carried. This important conclusion seems to hold out hopes that success may eventually be attained if the stability of the apparatus can be secured.

M. Drzewieki also discusses this question of stability. He shows that the transverse equilibrium can easily be maintained by a diedral upward slant of the wings of an aeroplane, arranging them like the sides of the letter V, but at a very obtuse angle, so that any tendency to tilt shall at once develop a greater pressure in that direction, and thus restore equilibrium. This was pointed out as early as 1809 by Sir George Cayley, in a remarkable series of papers published in *Nicholson's Journal*, which are well worth reading.

M. Drzewieki states the law of longitudinal equilibrium to consist in placing the centre of gravity of the whole apparatus vertically below the centre of pressure due to the angle of flight, and he gives the rule, first formulated by Joëssel, for determining this centre of pressure. He moreover states that these two centres of gravity and of pressure, must be but a very short distance apart, in order to prevent oscillations. This solution is substantially, for flat angles of incidence, the same as that of Sir George Cayley, who states that the centre of gravity must be at right angles to and below the centre of pressure; but it is to me doubtful whether this is the best solution for assuring the longitudinal stability of a flying apparatus, and this important, almost vital question is likely to prove a stumbling-block in the way of future experimenters.

Assuming it to be solved, M. Drzewieke estimates that an apparatus, built to the best possible proportions as to exposed surface and form, and sailing at an angle of 1° 50′ 45″, will require to drive it at 25 miles per hour but 5.87 H. P. per ton of its weight. This assumes the thickness of apparatus and consequent hull resistance to be but $\frac{1}{180}$ of its horizontal dimensions, while for birds it generally runs from 5 to 10 per cent. That is to say, that birds exposing a horizontal surface of say 100 sq. in. generally expose a

maximum cross-section vertically of 5 to 10 sq. in., while M. Drzewieki believes this can be reduced to the proportion of 1 sq. in. per hundred for an aeroplane.

My own estimate of the power required by a common pigeon gliding at an angle of 1° with the horizon was 9.33 H. P. per ton of his weight, and 10.49 H. P. per ton at an angle of 2° for this same velocity of 25 miles per hour.

These are considerably less than the powers required to drive a balloon of moderate size at the same speed, for we have already seen that the airship *La France* would require 51 H. P. to attain 25 miles per hour; or, as it weighs 2.2 tons, the motor would needs develop 23.2 H.P. per ton of the weight of the whole apparatus. For the balloon of double this size, the power required is at the rate of 10.34 H.P. per ton of apparatus. This power required would moreover increase in the case of the balloon, as the cube of the velocity, while M. Drzewieki shows that in the case of an aeroplane the power will increase only in the direct ratio of the speed, because as the velocity becomes greater the area sustaining surfaces required becomes less, and he estimates that an aeroplane will require 10.43 H. P. per ton to go 44.72 miles per hour, and 20.62 H. P. per ton of its weight at 89.44 miles per hour.

This brings up the question of possible motors, and if we confine ourselves for the present to 25 miles per hour, and assume the power required at 10 H. P. per ton of apparatus, we see at once that only a fraction of that weight can be devoted to the motor. Let us assume, and I think this is not far wrong, that only one-quarter of the weight can be apportioned to the motor and its supplies; the remaining three-quarters being required for the weight of the framing, the aeroplane surfaces, the various appurtenances, and the aeronauts, we then have but $\frac{2000}{4 \times 10} = 50$ lbs. per H. P. as the weight allowable for the motor and its supplies for such period of time as it is to consume in its trip. This does not greatly differ from the proportion in the pigeon, whose pectoral muscles weigh $\frac{1}{43}$ of his total weight, or 46 lbs. per H. P., including, it must be remembered, the stored-up energy which enables him to accomplish long flights without alighting.

Now, how does this compare with the weight of the engines manufactured by man? There are three classes of Motors in general use.

1. Steam-engines.
2. Gas-engines.
3. Electric motors.

The machines in common use, being designed chiefly for strength and durability, are needlessly heavy, and it is only by inquiring into what has been done for special purposes that we shall get an idea of their possibilities.

Thus as to steam-engines: Ordinary stationary machines weigh with their boilers from 500 to 1600 lbs. per H. P.; locomotives, from 200 to 300 lbs.; marine engines for Atlantic steamers, 480 lbs., and light launch engines—those of Herreshoff, for instance—some 60 lbs. per H. P. For aeronautical purposes, however, a steam-engine was built by Stringfellow,

which weighed but 13 lbs. and exerted 1 H. P., and another was built by Moy and Schill of 3 H. P. and 80 lbs. weight, thus being about 27 lbs. per H. P.

But these weights, while including the boiler, do not include the water and fuel. These supplies may be estimated at 22 lbs. of water and 4 lbs. of coal per hour, so that if a large engine can be built as light per H. P. 13 lbs. as that of Stringfellow, it would still need, if for so short a trip as two hours, 52 lbs. of supplies per H. P., making a total of 65 lbs., including the engine itself.

The principal weight is that of the water. It has been proposed to utilize part of this over and over again, by equipping navigable balloons with surface air condensers, but the difficulties in the way of this, chiefly from the added weight, are almost insuperable.

Next, therefore, gas and petroleum engines suggest themselves. As now made they are excessively heavy, weighing from 280 to 1000 lbs. or even more per H. P., so that the advantages of dispensing with the boiler and its water supply are completely lost. They are comparatively of recent invention, however, and it is believed that corresponding reductions of their weight can be made,* such as have been effected for the steam-engine, and as will be seen hereafter for electric motors, and that this is a promising field for experiment; for even if aerial navigation be an Utopia never to be realized, improvements which will permit a reduction in the weight of gas-engines are likely to cheapen their cost materially, and to extend their use, as well as the profits of their builders.

And, lastly, we will consider the electric motors, with which whatever of success the navigable balloon has so far attained has been accomplished. They involve, like the steam-engine, two separate parts, the motor proper and the generator, which latter may be either a primary battery or an accumulator.

The weights of the motors or ordinary dynamos used in this country run from 92 to 260 lbs. per H. P. developed, while abroad they run from 68 to 350 lbs. per H. P.; but the special dynamo used by Commandant Renard weighed but 26.4 lbs. per H. P., and a very small one, built of aluminum by M. G. Trouvé, weighed at the extraordinary rate of but 7.7 lbs. per H. P.

M. Trouvé is now building for the Portuguese Government a 10-H. P. dynamo, which will weigh less than 220 lbs., and which is to be used to drive a navigable balloon. The total weight of the motor, batteries for several hours of work, screw and accessories, is estimated at 1496 lbs., or at the rate of 149.6 lbs. per H. P. developed.

Contrary to expectation, accumulators are found, by comparison of numerous data from various makers, gathered by M. Tissandier, to be actually heavier than primary batteries. As they are charged to last various periods of time, it is necessary, in order to compare them, to reduce them to the common standard of one H. P. for one hour, and it is then found that

* Since reading the lecture, the author has seen an account of a three-cylinder petroleum engine built for marine purposes, in France, which develops 5 H. P., and weighs but 440 lbs., thus being in the ratio of 88 lbs. per H. P. It consumes, as near as may be, 1 lb. of petroleum per H. P. per hour.

accumulators of the best make weigh from 107 to 162 lbs. per H. P. per hour, a fair average being 135 lbs.; while the primary battery of Commandant Renard is stated by himself to weigh but 66 lbs. per H. P. per hour, and to last a little over 10 hours, this being the present possible length of his trips. Thus the motor is decomposed into 26.4 lbs. of dynamo and 103.6 lbs. of primary battery, making in the aggregate the 130 lbs. per H. P., as has already been mentioned.

It will be observed that all these weights of motors are in excess of the 50 lbs. per H. P., which have already been assumed as the weight which can be afforded for aerial navigation, and yet not so greatly beyond it as to shut off all hope of improvement. Hitherto it has not been generally realized that the chief obstacle in the way of success is the want of a light motive power, one which shall develop great energy with little weight, and it is possible that when inventors turn their attention in this direction still lighter motors than at present known shall be the result.

It has been suggested repeatedly that a suitable motor for aerial navigation may be found by the invention of some kind of explosive engine, utilizing the force of gunpowder, nitro-glycerine or some other substance which can be flashed from the solid or liquid form to the gaseous condition; but such a motor is yet to be invented, and, what is more difficult, regulated and perfected. Attempts in this direction, notably with gunpowder, actually antedate the steam engine, but the difficulties of controlling power so intense and so rapidly generated have hitherto been found too great to be overcome. It would be rash to say that they cannot be, although true explosive engines have thus far exhibited an unpleasant irregularity of working, frequently giving deficient strokes, but at times coming out with powerful explosions which may kill the inventor.

It is believed that gas or petroleum engines, which are also explosive engines, with the difference that the working substance is already in the gaseous form, and thus subject to fewer irregularities of expansion, present greater chances of success in obtaining a light motor for aerial purposes, and would-be inventors are advised to turn their attention to this rather than in other directions.

But even if the motor is worked out, there will remain some serious difficulties to be encountered before man can fly through the air at satisfactory speeds. The first of these is the requirement for absolute stability which has already been alluded to. The apparatus must balance itself in the air automatically, and must possess sufficient surface to come down as a parachute should the machinery break down while sailing. The second difficulty will consist in the necessity for obtaining high initial velocities, so that the sustaining pressures shall be great, and that the dimensions and weight of the apparatus may consequently be reduced to a mimimum. This difficulty of getting under way is the principal one encountered by birds, and probably furnishes the reason why none of them have attained the size of land and marine animals.

It has been pointed out that there are no flying birds much over 30 lbs. in weight, and, reasoning from analogy, it has been argued that man cannot hope to improve upon nature in this direction; but not only are birds much

more complicated in structure than a flying machine needs to be, having many functions to perform such as wing-folding, feeding, reproduction, etc., besides that of mere flight, but they evidently expend much more energy in starting than in any other portion of their evolutions.

The smaller ones jump from the ground into the air with all their might, and then beat their wings with much greater rapidity and amplitude than in their normal flight. If rising vertically they soon exhibit signs of distress. The larger birds in starting from the ground are compelled to run considerable distances, always against the wind, in order to gather headway and supporting power, and even with the most energetic flapping they cannot rise at a steeper angle than 45°. All birds prefer to start from a perch, for by directing their first course downward they gather velocity from the action of gravity; at times some of the larger ones obtain relative velocity by simply spreading their wings to the breeze while yet on the perch, the object in every case being to avoid the great exertion required to obtain speed, for once fairly under way they are masters of their movements.

Resort to some equivalent devices will evidently be open to flying machines, but it is evident that until the question of stability has been thoroughly worked out, such experiments will be exceedingly dangerous; no such apparatus has yet succeeded in raising itself from the ground with the whole of its motive power, and the most that can be said at present is that recent elucidations of the laws of flight seem to indicate that it is not impossible for man to succed with an aeroplane.

There are probably scores of shapes which can be made available for such machines, just as there are hundreds of forms of birds who display various peculiarities in their flight; but in every case there will be the same requirements as to a light motor, absolute automatic stability and some device for gaining initial velocity, as well as for landing safely. This will require much experimenting, and a beginning has scarcely been made, so that even granting the accomplishment possible, the working out of the problem may prove to be slow.

Success might be much hastened, however, by a working association of searchers in this field of inquiry, for no one man is likely to be simultaneously an inventor, to imagine new shapes and new motors; a mechanical engineer, to design the arrangement of the apparatus; a mathematician, to calculate its strength and tresses; a practical mechanic, to construct the parts, and a syndicate of capitalists, to furnish the needed funds. It is probably because the working out of a complex invention requires so great a variety of talent, that progress in other fields has proved so slow, several generations sometimes passing before an important invention such as that of the steam-engine, the telegraph, or the reaping machine is finally perfected and brought into general use.

CONCLUSION.*

To sum up, therefore, the present "State of the Art"—if it has yet progressed sufficiently to be called an art—may be stated as follows:

*I have refrained in this paper from discussion of the various mathematical formulæ concerning air resistances, because not only are they a matter of controversy, which must hereafter be

A measurable success has been attained with navigable balloons. They have been driven 14 miles per hour, and it is possible that speeds of 25 to 30 miles an hour, or enough to go out when the wind blows less than a brisk gale, are even now in sight. Very much more speed than this is not likely to be obtained with balloons, for lack of sufficiently light motive power, and because of unmanageable sizes.

Much greater speeds can perhaps be attained eventually with aeroplanes; recent investigations indicate this; but even a beginning is prevented by the lack of a light motor, and by questions as to the stability of the apparatus as well as to safe ways of gaining high initial velocities. Whether these difficulties will ever be overcome no one knows, but they indicate the direction for investigation and experiment, while the probable benefits to man of a solution of the problem are so great that they are well worth striving for.

Success with aeroplanes, if it comes at all, is likely to be promoted by the navigable balloon. It now seems not improbable that the course of development will consist, first, in improvements of the balloon, so as to enable it to stem the winds most usually prevailing, and then in using it to obtain the initial velocities required to float aeroplanes. Once the stability of the latter is well demonstrated, perhaps the gas-bag can be dispensed with altogether, and self-starting, self-landing machines substituted, which shall sail faster than any balloon ever can.

If we are to judge of the future by the past, such improvements are likely to be won by successive stages, each fresh inventor adding something to what has been accomplished before; but still, when once a partial success is attained, it is likely to attract so much attention that it is not impossible that improvements will follow each other so rapidly that some of the present generation will yet see men safely travelling through and on the air at speeds of 50 or 60 miles per hour.

ABSTRACT OF MUNROE'S LECTURES ON CHEMISTRY AND EXPLOSIVES.

By LIEUT.-COLONEL J. P. FARLEY, Ordnance Dept. U. S. A.

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(Continued from Journal No. 60.)

GUN-COTTON.

BRACCONOT, in 1832, treated starch, ligneous fibre, etc., with nitric acid, the resulting substance being known as "xlyoidine," a highly combustible body.

Pelouze, in 1838, treated paper and cotton with nitric acid, and produced a substance which exploded under blow or pressure and inflamed at 180° C.

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settled by experiment, but also because the figures of M. Drzewieki, which are based on empirical formulæ, may be in need of revision; for the benefit of the curious in such matters, however, it may be stated that his paper can be obtained (in French) in *L'Aéronaute* for October, 1889.

Dumas in a similar manner prepared from paper and nitric acid, about the same time, a substance he denominated "nitramidine," and employed it for cartridges.

Schoenbein, in 1845, discovered the type of gun-cotton used at the present day. At that time its detonating property had not been discovered, but its effectiveness as compared with that of gunpowder was found to be in the ratio of 4 to 1.

Schoenbein used twenty to thirty parts of acid with one of cotton;—the acids being a mixture of nitric and sulphuric and in the ratio by weight of 1 to 3.

The action was continued for one hour, the sulphuric acid acting as the exsiccating substance, thus preventing the dilution of the nitric acid. After reaction the product was repeatedly washed, at one time with a solution of potash to remove traces of acid, and at another with pure water to remove traces of the salts left from the potash. A number of explosions occurred with gun-cotton in 1847–48, which was a very discouraging influence, but which were, as the sequel shows, justly attributed to causes which have since been remedied. These may be enumerated as follows: Failure to purify the cotton, use of weak acids, limited time immersion, incomplete conversion, and to traces of acid remaining after the reaction.

The impurities in the cotton itself are both natural and artificial, such for instance as oil, dust, water, etc., and when these are subjected to the action of acids, the unstable compounds formed within the cotton become the *nucleus* for spontaneous decomposition. Heat and waste of material also result from the presence of water.

Von Lenke employed the strongest acids and followed up the reaction by as thorough purification as possible, employing the centrifugal thrower and water cascade for the purpose.

Success attending his efforts, no less than thirty Austrian batteries were supplied with gun-cotton as a propellant, but frequent explosions due to spontaneous combustion during the storage of the gun-cotton led to its disuse.

Abel, in 1865, reduced the cotton to pulp, moulded it under pressure, and cheapened the manufacture of the gun-cotton by using cotton waste from which the impurities could readily be removed.

Through pulping and compression the density was materially increased while its efficiency in no wise impaired.

The explosion of thirteen and half tons at Stowmarket, England, in 1871, was, after official investigation, attributed to malicious parties having introduced acids into the gun-cotton after its manufacture, and as no explosions have resulted since that date, this view seems to be sustained. Von Lenke's method (improved by Abel) as described, has been very generally adopted in the manufacture of gun-cotton.

Gun-cotton consists of carbon, hydrogen, oxygen and nitrogen, it is a true salt of the class known as *esters*, and not a nitro-substitution compound, as the nitrogen oxide is connected to the carbon atoms through the interposition of oxygen atoms.

Cellulose has been regarded as a tri-basic alcohol $C_6H_7O_2$ (O H)$_3$ and the reaction in the conversion of this cellulose is thus expressed :

$(C_6 H_7 O_2) O_3 H_3 + 3 H O N O_2 = (C_6 H_7 O_2) O_3 (N O_2)_3 + 3 H_2 O.$

An instance where the oxygen atom is directly attached to the carbon atoms is shown in the expression for picric acid $C_6 H_2 (N O_2)_3 O H$, a nitro-substitution compound, as distinguished from the nitric ester, above.

Cotton is a purer cellulose than either wood or saw-dust and therefore is preferred in the manufacture of gun-cotton. Gun-cotton proper—trinitro-cellulose—is insoluble in a mixture of common ether and alcohol but soluble in a mixture of ether and ammonia and in acetone ($(C H_3) C O$). It may also be dissolved in sodium hydroxide but in neither hot nor cold water. The low orders of gun-cotton mono and di-nitro-cellulose are both soluble in alcoholic ether and are denominated *soluble* gun-cottons.

The density of dry uncompressed gun-cotton is .1 to .3 and of dry compressed gun-cotton 1.4 to 1.5.

It is less hygroscopic than gunpowder, its usual humidity being 1.5 to 2 per cent. and this may reach 2.75 per cent. without affecting its inflammability.

Gunpowder may absorb a large percentage of moisture, but whilst this greatly impairs its ballistic qualities, with gun-cotton increase in the percentage of moisture is accompanied a rapid fall of pressure in the gun, but without a corresponding loss of velocity in the projectile, affording a means for neutralizing the *brisant* effect of gun-cotton in the piece.

Gun-cotton *dry*, if properly manufactured, is comparatively safe to handle and transport, but when *wet* and hermetically sealed, is absolutely safe.

Its decomposition is indicated by nitrous fumes coloring the atmosphere a brownish red, the substance shows pasty yellow spots, and later is converted to a pasty yellow mass having but one tenth the original volume of the gun-cotton. It then swells up as the gas is evolved and again shrinks as it changes to a gummy residue with much smaller volume and finally dries up and becomes a brown horny substance.

If during decomposition the gun-cotton gas is confined, the compression develops heat and explosion results, but when unconfined, no such effect follows.

Wet gun-cotton, compressed, and containing slight traces of acid, will probably not decompose owing to the water which is present and which serves to prevent a rise of temperature to the danger point.

Collodion cotton (di-nitro-cellulose) is, as we know, affected by light, but gun-cotton (tri-nitro-cellulose) is not, except when moist or damp, in which case sunlight has an appreciable influence upon it.

When dry gun-cotton has been exposed to air for a period of three months, its stability, as determined by the heat test, has if anything, been improved, just as Abel found it to be by exposure to diffuse daylight.

Water acts as a perfect protection to gun-cotton, even when it is subjected to a very high temperature and under extremely severe conditions (except when exposed to sunlight).

If thoroughly damp, the compound is as well protected as if fully immersed in water, but water in gun-cotton freezes and breaks down its physical structure. Dry gun-cotton on the other hand, is not affected by low

temperature, nor does alteration of temperature from hot to cold influence or change it in any particular.

These remarks apply simply to pure gun-cotton, since, when it contains impurities, it will decompose when heated.

It is susceptible when dry to percussion, pressure and friction, but shells have been fired against stone walls and broken upon impact without exploding the shell charge of dry gun-cotton.

Gun-cotton when wet, has been subjected to a pressure of 13,000 pounds per square inch, but the usual force employed to compress it is 6300 pounds.

E. O. Brown in 1868, demonstrated that, with a small charge of fulminate of mercury, used as a detonator, by detonating an initial charge of dry gun-cotton, in contact with wet gun-cotton, the latter could be detonated and the effect would be even greater than that due to a like charge of dry gun-cotton.

NITRO-GLYCERINE.

It having been asserted by some chemists that nitric acid was absorbed into the pores of gun-cotton as nitre is by paper in the manufacture of touch paper, whilst others maintained that there was a substitution of certain components of nitric acid for those of the cotton, Pelouze and his pupil Sobrero to settle the question, substituted for the cotton glycerine, which is a substance chemically analogous to it, believing that in the event of an explosive body resulting from this compound, it would be demonstrated that replacement must have taken place, for they held that a liquid like glycerine could not, by any possibility, absorb and retain in its pores by mere physical force a liquid like nitric acid. The result was the production of nitro-glycerine.

The great power of this explosive nitro-glycerine and the readiness with which it exploded conspired to make the chemist reluctant at first, to pursue investigations with it. Although discovered by Sobrero in 1846, little was done with it until the Crimean war, when its *reputed* presence is said to have deterred the English fleet from entering the harbor of Cronstadt, though up to that time it had been employed only in small quantities and then principally as a medicinal agent under the name of *glonoine*.

Its practical use as an explosive like that of gun-cotton was due to the discovery by Alfred Nobel of its capacity for being detonated (1863). Mowbray and Hill were the first to perfect its manufacture in this country.

The reaction between the nitric acid and glycerine is expressed by the equation $C_3 H_5 O_3 H_3 + 3 H O N O_2 = C_3 H_5 O_3 (N O_2)_3$.

Several unstable compounds may result, such as the mono and di-nitro-glycerine, but a stable compound, the tri-nitro-glycerine, results when proper precautions are taken, that is, when three of the atoms of hydrogen in the glycerine are replaced by three atoms of nitryl ($N O_2$) in the three molecules of nitric acid. The purest glycerine and strongest nitric acid should be employed in its manufacture. An exsiccating substance (sulphuric acid) is added to absorb the water which is a product of the reaction and which, if not taken up, dilutes the nitric acid and aids in the formation of the lower nitric esters. This water, combining with the sulphuric acid,

forms a hydrate of sulphuric acid and this combination develops heat, which either explodes the compound or else converts the nitro-glycerine into oxalic acid and other products. The temperature therefore during manufacture must be kept down by the external use of ice and cold water. Strong nitric acid s. g. 1.49 to 1.51 should be mixed with twice its weight of strong sulphuric acid s. g. 1.84, into which mixture the glycerine should be added drop by drop. The resulting compound is then drawn off and thoroughly washed.

The oily liquid (nitro-glycerine) s. g. 1.6, is at first creamy white and opaque, but becomes transparent and colorless by standing. It frequently appears of a yellow or brownish yellow color (in commerce), is very slightly soluble in cold water but does not mix with it. It has a sweet, pungent, aromatic taste, is an active poison, mere contact producing headache and sickness, and its antidote is strong black coffee. Nitro-glycerine is soluble in methyl (wood alcohol), ethyl and amyl alcohols (fusel oil). It is also soluble in carbon di-sulphide and in all proportions in ether (ethyl alcohol and sulphuric acid); in chloroform, lgacial acetic acid, phenol, and sparingly in glycerine. Freshly made, opaque, nitro-glycerine freezes at from —3° F. to — 5°, while the transparent or "cleared" freezes at 39° to 40° F., and in both cases to a white crystalline mass. Once frozen it remains so, even when exposed for some time to a temperature sensibly above the freezing point. It is conveniently and safely thawed by placing the vessel containing it in a larger one partially filled with water at 100° F. Most of the accidents which have occurred with nitro-glycerine have been due to carelessness in thawing. Frozen explosives should not be placed directly into vessels containing the hot water, nor should they be brought into contact with any surface heated by other than the water process described.

Pure nitro-glycerine does not decompose spontaneously at any ordinary temperature, but if it is impure and contains free acid, decomposition will take place. The acid is usually removed in the washing process, in which alkaline solution as well as pure water have been employed. If the compound is perfectly *pure*, it may be stored for years without risk of spontaneous decomposition, but when it contains the free acids, the decomposition proceeds in a slow and tranquil manner. This is first evidenced by the disengagement of nitrous vapors, which color the liquid green, the development of nitrogen and carbon dioxides and of crystals of oxalic acid, while after some months the entire mass is transformed into a greenish gelatinous mass of oxalic acid, water and ammonia. If the temperature be high, as when heated by the sun, decompositon is accelerated, but explosions from this cause are not likely to result when the quantity of the explosive is not large.

Pure nitro-glycerine is not sensitive to friction or even to moderate percussion unless pinched between metallic surfaces. If placed on an anvil and struck with a hammer only the particle struck explodes as a rule; and this scatters the remainder,

In fact, *pure* nitro-glycerine has been dropped from a height of 1000 feet without exploding, but when in a state of decomposition, violent explosion would result from a slight shock or blow. If *completely confined*, a blow will

explode *pure* nitro-glycerine since it is nearly incompressible in its liquid form. When local explosions occur, due to the drop of a hammer for example, and the remainder is blown away, the escape is due to the lift on the hammer, since if it were thoroughly confined and there were no outlet, the effect of the explosion of the first particle would be communicated to the whole mass.

As nitro-glycerine is readily detonated, and requires but little tamping for blasting; loose sand or even water will answer as a tamp.

It is estimated that nitro-glycerine has 8 times the force of gunpowder weight for weight, but owing to its quickness of action its effects are much more manifest on rocks or materials offering great resistance, than when acting upon a yielding substance.

Nobel states that the complete explosion of nitro-glycerine $4\,C_3\,H_5\,O_3\,(N\,O_2)_3$ gives carbon dioxide ($12\,C\,O_2$), water ($10\,H_2\,O$), nitrogen ($6\,N_2$) and oxygen (O_2). The density of nitro-glycerine is 1.6, and hence one cubic centimetre weighs 1.6 grams, yields 25 liter of gas, and (the volume remaining constant) exerts a pressure of 25,000 atmospheres, or 375,000 pounds per square inch.

It is rarely used in its liquid shape, except for the purpose of shooting oil wells in order to free them from the paraffine with which they become clogged, or to shake the oil bearing sandstone and increase the yield.

If used for blasting it may be poured into the bore hole and tamped with water, but if there should be cracks leading to the bore hole it will escape and accidents in future blasting may result. Nobel found that by adding 15 to 20 per cent. of methyl alcohol to the nitro-glycerine it was rendered insensitive until desired for use, and that by afterwards adding water the compound would be precipitated, unchanged and without having lost any of its qualities or properties. This scheme is however, impracticable for commercial purposes.

DYNAMITE.

Dynamite originally was nitro-glycerine absorbed in the pores of an inexplosive substance by capillary attraction. It was discovered accidentally through nitro-glycerine leaking on to saw-dust. The inexplosive substances used for dynamite are charcoal, silica and paper, which are converted to powder and when mixed with nitro-glycerine the new substance resulting is in a high degree insensitive to shock, and can be burned in moderate quantities over a fire without exploding. Kieselghur (silica) is an excellent absorptive and firm retainer, possessing chemical stability and inability to react; for which reason, as well as on account of its abundance and cheapness, it was adopted from amongst the many solids offered as being the best adapted for the manufacture of dynamite.

The Kieselghur, which is commonly known as tripoli or rotten stone, is the inorganic or shell remains of millions of minute organic beings known as infusoriæ or diatoms. It owes its red tinge to the iron it contains and is calcined before use to drive off the organic remains and water. Richmond, Virginia, is built upon a deposit of Kieselghur twenty feet deep, and this substance is found in large quantities near Petersburg, Virginia, and Herrings Bay, Md. Kieselghur takes up and retains three times its weight of

nitro-glycerine even at high temperatures, and if the glycerine should contain traces of acid the same decomposition may be expected in dynamite as under similar conditions occurs in nitro-glycerine. For this reason a small quantity of sodium carbonate or carbonate of an alkaline earth such as magnesium carbonate, should be added.

Dynamite No. 1, is granular, has a pearl gray or reddish color and is plastic like brown sugar, its density ranging about 1.6. It is usually put up in stout paper cases, paraffined for protection against moisture or water, a very necessary precaution as water drives the nitro-glycerine out from the Kieselghur. It is better and safer in its soft plastic state than it would be if a liquid, and although it is comparatively insensitive to blows when *quite cold*, yet at 350° F. it will explode under the impact of a dime. At ordinary temperatures it is readily exploded by detonation, jar, blow and vibration. High temperatures cause exudation of the nitro-glycerine and therefore it should be tested from time to time to determine its condition, and manufactured, so as to resist exudation.

It freezes at 40° F., remains frozen at temperatures exceeding this; and if solidly frozen can only be detonated with difficulty; but if loose and pulverulent it may be detonated, though its violence is much diminished. When frozen it is therefore practically useless for blasting and must be thawed or tempered before use. It is reasonably safe to ignite a cartridge of unfrozen dynamite and therefore many think it safe to warm frozen dynamite on a shovel or in an oven, but dynamite or nitro-glycerine preparations, are, when gradually warmed up to a temperature approaching their exploding point, extremely sensitive to the least shock or blow and explode with great violence. It would therefore, seem to be necessary to take the precaution not to heat up a poor conductor, so that the exploding point should be reached at *any part* of the body of dynamite. Frozen dynamite is much less sensitive to blows or friction, than when unfrozen, but much more sensitive to explosion by ignition, since the unfrozen may burn away gradually.

The success attending the use of dynamite No. 1, has led to other combinations of nitro-glycerine with inert and explosive substances, and Mowbray's mica powder soon followed after the appearance of the dynamite No. 1.

MOWBRAY'S POWDER.

This powder has greater brusqueness of action than the Kieselghur dynamite, the nitro-glycerine being wholly held superficially on the plates of mica, whilst with the Kieselghur it is partially held in the interstices, hence the explosive reaction travels more rapidly in the first than in the second.

DYNAMITE WITH ACTIVE AND INERT BASES.

As less powerful agents than dynamite No. 1, were required to break up soft bodies, and increasing the Kieselghur beyond 70 per cent., rendered the compound to a greater or less extent inexplosive; gunpowder mixtures containing combustible and oxidizing materials were employed as an absorbent. Such an explosive base is denominated "dope," and whilst it is capable of retaining considerable nitro-glycerine, yet when its proportion is

reduced to even so low as 5 per cent. the gunpowder dynamite will detonate. Dynamites therefore may have both *inert* and *active* bases.

Kieselghur will retain three times its weight of nitro-glycerine. Charcoal from cork, (in Borland's Carbo-dynamite) will retain nine times its weight of nitro-glycerine.

The inert bases for dynamites are Kieselghur, mica, asbestos, magnesia, alba, ashes of Boghead mineral, plaster of Paris, sulphate of magnesium and alum, red-lead and plaster of Paris, Kieselghur and naphthaline, sand and coke; sand, ochre, charcoal and resinous matter; sponge or vegetable matter and plaster of Paris, spongy vegetable substances with glycocoll or chondrin rosin; coarsely-ground farinaceous substances, corn-meal, etc., and charcoal from cork.

Dynamites with active bases contain potassium, sodium and ammonium nitrates, separately or combined, mixed with such combustible substances as charcoal, starch, sugar, coal, peat, decayed wood, sulphur, etc.

The lignin-dynamites containing saw-dust, together with oxidizing bases, are really dynamites with gunpowder bases; they possess the advantage of resisting the action of water, and therefore nitro-glycerine does not exude from them as from other dynamites, through the action of water.

Of the group of dynamites of which cellulose nitrate is the base, either in whole or in part, it may be said that, when nitro-glycerine is detonated free oxygen is evolved, while when gun-cotton is detonated carbon monoxide results. If then, by mixing the two, complete combustion is obtained without any uncombined oxygen being liberated, a more powerful explosive is produced. As a fact this is only fully realized in explosive gelatine.

Glukodine and Thunder Powder are both dynamites, the former consisting of nitro-glycerine and nitro-saccharose (cane sugar) and the latter nitro-glycerine and nitro-glucose (grape sugar), both products being mixed with a lignin explosive dope. Nitro-substitution compounds are also used as dynamite dopes.

The potential energy of a dynamite with an inert base cannot be equal to the potential energy of the nitro-glycerine contained in it, owing to the heat absorbed by the inert substance present which reduces the heat that would otherwise be imparted to the gas generated.

If gunpowder be mixed with nitro-glycerine and the latter be detonated the gunpowder will also be detonated and the resulting force will be the sum of the forces of the two explosives.

When other nitrates than the potassium are used in dynamite for the "dope," such salts, although cheaper, render the dynamite unstable, and especially dangerous in warm or drying weather.

In order to ascertain if the nitro-glycerine is forced out or oozes out of the dynamite, place a drop of the suspected substance on blotting paper. If greasy stains appear and do not dry off, place the stains on an anvil and strike them with a hammer; when if due to nitro-glycerine they will explode with a loud report and when lighted will burn with a crackling sound and yellow to greenish flame. If gradually heated on an iron plate, by heating the plate itself, a sharp report will result. The nitro-glycerine can also be detected by the test tube and with methyl alcohol.

EXPLOSIVE GELATINE.

The products resulting from the explosion of gun-cotton are those of *incomplete* combustion, but Nobel obtained theoretically complete combustion of the gun-cotton by dissolving the soluble form in nitro-glycerine by aid of heat. Explosive Gelatine, sometimes termed Gun Dynamite or Blasting Gelatine, resulted (after cooling) in the form of a gelatinous paste, tough and leather-like, and possessing a honey-yellow color like ordinary jelly.

Its qualities are largely dependent upon the quantity and chemical conditions of the cellulose nitrate used, and the method of manipulation during manufacture.

The percentage of cellulose nitrate varies from four to eight. The mixing is performed in a metal vessel set in a water bath in which the nitro-glycerine is heated to about 100° F. The well-washed and purified and dried cellulose nitrate is then added in portions and stirred in as fast as it dissolves. The explosive gelatine has a density of 1.6, does not absorb water, and when placed in it is unaffected, except superficially; the cellulose nitrate, which is thus separated on the surface, acting as an impermeable coating to protect the interior.

This compound burns in the open air without explosion when operated upon in small quantities without previous heating, but if heated to its ignition point when confined, it explodes. It has been maintained for eight days at a temperature of 158° F. without signs of decomposition. Heated slowly it explodes at 399° F., heated rapidly at 464° F. At low temperatures it freezes into a hard whitish solid with crystalline structure, but its freezing point has not been definitely ascertained, as some cartridges resist the temperature of a mixture of ice and salt and others freezing at 35° to 40° F.

Explosive gelatine is much more insensitive than the other high explosives and specially strong detonators, or ordinary detonators with gun-cotton or dynamite primers are required to explode it; requiring as it does confinement to develop its full power, or rather its capacity for transmitting the explosive reaction. A train of it cannot be exploded except by means of a very powerful initial detonation, and in layers, the thinner the gelatine the more sensitive it is.

Its sensitiveness materially increases when it is frozen, and it may then be readily detonated, and exploded by the impact of rifle bullets. Its sensitiveness may be diminished by adding camphor or other substances rich in carbon and hydrogen, such as benzine or nitro-benzine. These bodies are soluble in nitro-glycerine, and four per cent. of camphor mixed with Blasting Gelatine gives the Military Explosive Gelatine.

In appearance it is like the first-named compound, is less sensitive and emits the odor of camphor, but with exception of its insensitiveness it does not differ in other properties. Its temperature of explosion, due to the addition of camphor, is raised from 572° F. to 626° F.

Berthelot finds that the theoretical pressure of explosive gelatine is identical with that of nitro-glycerine, but its theoretical efficiency is less, in the ratio of 1.4: 1.45 and this has been confirmed by practice. Gen.

Abbot finds the relative intensities in the horizontal plane for No. 1 dynamite, nitro-glycerine and explosive gelatine (when fired under water), to be 100: 81: 117, while by a later comparison the explosive gelatine of the Nobel's Explosive Company of Glasgow, attained an intensity of 142. The higher results obtained by Abbot may be due to the comparative slowness with which the detonation is propagated in this explosive, by which it has a longer interval for doing work on the metal of the pressure gauge than the nitro-glycerine has, and that this greater persistence of action enables it to produce a more marked impression.

Berthelot holds that the effect of the camphor, in increasing the insensitiveness of the explosive, results from the increased elasticity and solidity which the explosive thus acquires, in consequence of which the initial shock of the detonator is propagated through a much greater mass of the substance than it would be if the camphor were not present; so that the sudden and local elevation of temperature, necessary for inducing the chemical and mechanical action which results in detonation, is not realized except by the use of a very powerful initial detonator.

Camphor does not exert, according to this theory, any action on discontinuous powders, and this is shown in practice with potassium chlorate powders.

Explosive Gelatine is an ideal explosive owing to its solid form, plastic nature, its greater power and insensitiveness, but unfortunately in several instances it has become decomposed during storage and without any apparent cause. Such decomposition has not in these instances been attended by explosion but it constitutes an element of danger in the use of this explosive.

PHENOMENA AND THEORIES.

Various phenomena accompany explosions, and theories have been advanced to explain them.

The effect produced by an explosive is caused by the blow or impulse imparted through the rapid production from it of a large volume of highly heated gas. The explosive character of the change depends upon the change of state produced and the time required for the change to take place.

Nitro-glycerine is much more powerful and violent than gunpowder, since it generates a larger volume of gas in a shorter time, while fulminating mercury is not more powerful than gunpowder, since the quantity of gas given off and the temperature of reaction are less, but it is more *violent*, because the decomposition goes on more quickly. The kinds and quantity of gas given off depends upon the chemical composition of the explosive and character of the decomposition. The heat evolved during reaction increases the tension of the gas and is an absolute quantity, whether the reaction goes on rapidly or slowly, but the *explosive effect* depends upon the *rapidity* of formation of the gas.

The same substance produces different effects under varying conditions of fire. Nitro-glycerine liquid at temperatures above 40° F., is violently exploded by a fuse of 15 grains of fulminate of mercury and below that temperature it freezes and is fired with great difficulty.

Dynamite is in a more convenient mechanical condition than the liquid

nitro-glycerine, is safer, and its rate of propagation of explosive reaction is less.

The same mixture of charcoal, sulphur and saltpetre gives a very different effect if in large grains from when in small grains.

Gun-cotton can be prepared in so many ways that it presents the most marked example of the effect of mechanical state. Flame applied to loose uncompressed gun-cotton will flash it off; if spun into threads or woven into webs its rate of combustion may be much reduced. Powerfully compressed and damp it burns slowly. Dry gun-cotton may be exploded by a fulminate fuse, wet gun-cotton requires the explosion of a small amount of dry.

Confinement is necessary in order to obtain the full effect of all explosives, but the more rapid the explosion the less confinement is required, and with sudden or violent explosives it may be neglected altogether. Nitrogen chloride is the most sudden and violent of all explosives and the thin film of water with which it is covered after being prepared, is a sufficient confinement. If nitro-glycerine be laid on blocks of stone the atmosphere itself acts as a confining agent. Gunpowder on the other hand being slow in action requires strong confinement, and when used in spar torpedoes, the fuse should be placed in the hollow spindle which is pierced with many holes to facilitate more rapid ignition of the powder charge.

Since the atmosphere acts as a tamping, dynamite, like nitro-glycerine, *may* be placed on rocks, and fired unconfined, to shatter them.

The chemical action or change that takes place during the explosion of nitro-glycerine is very nearly the same as in burning gunpowder, the difference being that, while in the powder the carbon and oxygen atoms belong to different molecules, in nitro-glycerine they belong to the same molecule. In both cases the carbon burns, but in the nitro-glycerine the combustion is within the molecule.

Gunpowder grains consist of millions of molecules and the chemical union of the oxygen of the nitre with the carbon atoms of charcoal can take place only on the surface of the charcoal grains; the first layer of molecules must be consumed before the second can be reached and so on; hence the process, although very rapid, must take a sensible time. Where the atoms are in one and the same molecule, the combustion is essentially instantaneous. According to Cooke nitro-glycerine yields nine hundred times its volume of gas and gunpowder only about three hundred times that of the solid grain. Assuming that the gas from a certain quantity of nitro-glycerine when exploded on the surface of a rock, is one cubic yard, if then the rock resists and the air gives way, the work done on the air is nine yard tons or about 60,000 foot-pounds. This work is done in an excessively brief period and if less work is required to split the rock, the rock yields and not the atmosphere. Had gunpowder been used, the volume of gas would have been but one third that produced by the nitro-glycerine or its work would have been but 20,000 foot-pounds. Moreover, the duration of the explosion being at least one hundred times longer than before, the work to be done during the same exceedingly short interval would be only 1-100 of 20,000 foot-pounds, or 200 foot-pounds; hence it would in this case have

been easier to lift the air than to break the rock. In fact the gas and air may be regarded as an anvil (when nitro-glycerine is employed) against which the rock may be split, and the whole action assimilates to that of meteoric masses, moving with planetary velocities penetrating our atmosphere. The explosions of meteors which have been witnessed are simply the effect of their concussion against the aeriform anvil.

In an explosive reaction the mode of bringing about the change exercises an important influence. Heat applied either directly or indirectly is the principal cause of an explosion. Flame from a percussion cap or primer directly, ignites the charge; fine platinum wire (in contact with an explosive) heated by an electric current; friction, percussion or concussion produce the same effect.

The agency of a blow explodes many substances and is (for a falling body) in proportion to the weight of the body, the height of its fall, the force by which it is impelled, the velocity of its motion, the mass and hardness or rigidity of the anvil, and the quantity and mechanical condition of the explosive agent struck, as well as to the ready explosibility of the explosive. Thus a sharp blow from a small hammer is better than the simple fall or weak blow from a large hammer, and when a wood or lead support is used for the anvil, the work is largely transmitted through the explosive to the wood or lead. Should the explosive be too thick or in a loose or powdered condition its particles will yield and further reduce the force due to the blow.

Explosion of an explosive due to a blow is the result of heat sufficient to establish energetic chemical change by the expenditure of force in the compression of the material, or by the friction of the particles against each other. If chemical change, due to heat, goes on instantaneously throughout the mass, it is called *detonation*. The theory for the production of detonation requires that a *small part* of the mass should be raised above a given temperature, rather than that a larger portion should be raised below the proper temperature.

Detonating explosion may induce similar explosions in other portions of the same matter either in contact with it or very near it, but not in contact and separated it may be, by glass, water, metal plate or any other medium calculated to prevent heated particles from being projected from one portion to the other. Abel showed that, not only would a detonating substance cause the detonation of another mass of the same substance, but that it would also cause the detonation of other substances.

The detonation of five grains of fulminate of mercury (confined in sheet metal cap) in contact with gun-cotton or nitro-glycerine detonates these substances. Nitro-glycerine exploded, explodes another mass of nitro-glycerine, even though both be immersed in water.

A *peculiar* kind of detonation is required to cause the detonation of an explosive,—this is illustrated in the case of nitro-glycerine and gun-cotton. The detonation of the latter detonates the former if in contact with it or in close proximity thereto, but the reverse is not the case; hence this property does not depend alone upon the *force* of the detonants, and this is confirmed by the fact that silver fulminate, nitrogen iodide and nitrogen

chloride are less efficient in causing detonation than fulminate of mercury, although the latter is not so violent as the others.

Abel concluded that a particular explosion or detonation may possess the power of determining, at the instant, similar violent explosions in distant masses of the same or in contiguous masses of other materials, which power, is independent of or auxiliary to, the direct operation of mechanical force developed by that explosion, just as a particular musical vibration will establish synchronous vibrations in particular bodies, while it will not affect others.

That is, that mechanical force acts with or without the aid of synchronous vibrations to produce detonation, but greater force is required when not so assisted. This is Abel's theory of synchronous vibrations.

Since vibrations called heat, light and electricity, cause the decomposition of chemical compounds when in a state of unstable equilibrium, then the question is asked why should not sound vibrations be capable of also inducing chemical change?

Berthelot disputes Abel's theory, and observes that the characteristic feature of the given musical note which is capable of determining each variety of explosion has never been established. Below a certain note the effects cease to be produced, and take place by preference (whatever the explosive) by the action of the most acute notes.

These effects he maintains cease to be produced at distances incomparably less than should be the case to accord with Abel's theory, which he says goes to show that detonations are functions of the *intensity* of *mechanical action*, rather than of *the character of determining vibration*. Similarly, the detonation ceases to be produced when the weights of detonating substance is too slight, and when in consequence the mechanical energy of the shock is much weakened.

Experiment, Berthelot affirms, confirms the existence of a direct relation between the *character of the detonation* and of the *intensity of the shock* produced by one and the same detonating substance.

If it be true that gun-cotton will cause nitro-glycerine to detonate while the reciprocal effect does not take place, then this absence of reciprocity can only be explained by that difference in the structure of the two substances which plays so important a part in the transformation of the mechanical energy into work and not on the ground of synchronism of the vibrations, since this latter theory would unquestionably demand reciprocal action.

Berthelot concludes that explosions by influence like detonation in contact, are due to the transmission of a shock arising from the enormous and sudden pressures produced by the nitro-glycerine or gun-cotton which is converted into heat within the explosive material.

He holds that sudden pressures produced by rapid reactions and the commotions resulting can be propagated through the ground and supports, or through the air itself. It is better propagated by solids than liquids, by liquids than gases, and of the latter better by compressed gases.

The interposition of soft substances breaks the continuity. Thus the use of a goose-quill, as a receiver, stops the effect of fulminate of mercury,

while a tube or a capsule of copper transmits this effect in all its intensity.

Detonation by influence takes place under water with gun-cotton, but the principle ceases to be true in passing from one medium to another.

Berthelot explains *explosions by influence* and the accompanying phenomena as being dependent upon the production of two forms of wave: one being the explosive wave properly so called, which is of a chemical and physical order, developed in the midst of the matter which detonates, the other being of a purely mechanical and physical series, which transmits the sudden pressure equally about the centres of the concussion to the adjoining bodies, with an intensity inversely as the square of the distance, and thus to a new mass of explosive material.

Neither Abel's theory of synchronous vibrations, nor Berthelot's theory satisfied Threlfall, and his experiments leave little doubt that the shock of an explosion must be transmitted in one of three different ways:

I. By actual bodily motion of the products of explosion through the surrounding medium, either alone or by becoming more and more mixed up with the medium itself, which is thereby set in motion.

II. By undulatory motion set up in the medium.

III. By vortex ring motion.

In the explosion of gunpowder and other slow explosives the energy is transmitted chiefly by I and II. The distance to which considerable energy is conveyed by waves of comparatively great amplitude being remarkable, as is illustrated by the effects of the explosion of powder magazines.

With the fulminates and high explosives the effect falls off very rapidly with the distance, and in water is of a direct character. This points to the third mode of transmission.

To illustrate, taking a sphere of fulminate of mercury, then by Vieille's experiments the outer portions of the fulminate are decomposed before they are removed to any appreciable distance.

This gives sudden expansion in *all* directions under perfectly symmetrical conditions. If practice does not allow of symmetrical expansion, as it does not—then the bounding surface of the explosion gases will be more curved in some places than in others; that is, the strain will be greater at some parts than at others, so much so as to lead to a "break down."

The compressed gases in this case escape by jets and in these jets there are sufficient conditions for vortex motion. If this vortex motion is set up, it is likely that much greater effects might be transmitted in some directions than in others, though at considerable distances the effects tend to become uniform in all directions. Threlfall believes that this view of the actions of explosions will enable us to explain several difficulties occurring in the interpretation of Abel's experiments.

In concluding this *résumé*, the writer desires to acknowledge the courtesy of Professor Munroe, in permitting one who is but a *layman*, to present to the readers of the JOURNAL some of the interesting matter of his course of lectures.

CAVALRY IN THE PAST, THE PRESENT AND THE FUTURE.

By a Superior Officer of Cavalry.

From the Revue de L'Armée Belge.

By LIEUT. J. C. BUSH, 5th Artillery.

(Continued from Journal No. 60.)

V.

SUCH examples seem to show that great attacks of cavalry, such as Napoleon ordered, will no longer constitute the rule, but the exception. Circumstances will certainly arise again when the happy intervention of a mass of determined cavalry will produce important results, like those ensuing from the furious charges of the Prussian cavalry at Vionville, which, thanks to fortunate circumstances, gave the German reserves time to arrive on the field. But, we repeat, this will not be the case generally, because progress and the changes brought about in the methods of war are opposed to it.

The true rôle of cavalry, for the future, will consist rather in partial attacks. It is in combination with the infantry division that cavalry can hope to render the greatest service on the field of battle.

The history of the campaigns of 1859, 1866, 1870 proves this abundantly to those who will take the trouble to study the battles of Solferino, Magenta, Sadowa, Woerth, Vionville, and the combats of Montebello, Merxleben, Trautenau, Nachod, Skalitz, Gitschin, Amiens, Orleans, Loigny, etc.

The facts agree with the reasoning, and in whatever way we consider this question, we arrive at the same conclusion.

Cavalry, obliged to remain at greater distances from the firing line until the moment for action arrives, must afterwards cross considerable spaces under rapid and effective fire, and must consequently modify its manner of fighting by reason of the changes in fire-arms and modern tactics.

We admit to-day great dispersion among our troops, but ground offers the most certain protection and it is natural that henceforth cavalry should divide its action and determine its movements by the nature of the ground as the infantry does.

With the enormous masses now put into action, occupying a front of several miles in extent, a battle is no longer, and can no longer be other than a succession of partial attacks in each one of which the three arms are called upon to take part. It becomes then indispensably necessary that mounted troops should be placed near the infantry in order to support them in their attacks or to extricate them at critical junctures.

It is by forming part with the infantry division, by considering its fortunes as bound up with those of the latter, that cavalry, ready to reply at the first warning to profit by the thousand incidents of the fight, can render the greatest service.

We will always have to contend against rain, fog, dust, smoke, and all

causes which obstruct the view, and we may believe with certainty that there will still occur moments of trouble occasioned by the change from one formation to another, moments of negligence, of exhaustion, which, by reason of a sudden attack, of a simple appearance of the enemy's cavalry, may have fatal consequences. It was due to fog that a Prussian division was able to approach Chlum unperceived and take it, so to speak, by surprise.

The allotment of cavalry to the infantry division does not, however, exclude the formation of large bodies of cavalry reserves. The commander-in-chief should have under his control a mass of regiments which he can dispose of instantly at an opportune moment, as, for example, to oppose the march of the enemy under critical circumstances, to attempt or support diversions or attacks against the adversaries' wings and to stop or oppose a turning movement of the latter. The chief must possess a force which he can deploy rapidly and of sufficient strength to complete a success or begin a pursuit effectively, or in case of defeat, to protect the retreat.

Hence we are led to admit that on the battle-field, as in the operations of campaign, cavalry will be divided into two fractions, one directly supporting the efforts of the infantry, the other forming the reserve. The later wars exemplify the judicious employment of our arm. Thus at Sadowa, the demonstrations of the Edelsheim Division and the Saxon cavalry at the extreme left, sufficed to stop and modify the movements of the Prussian troops who had only their divisional regiments to oppose them.

During the course of this same battle, if Benedek had not scattered his reserve cavalry along the whole front of his immense line, he would have been able, with it, to stop the march of the Crown Prince and would not have had a Prussian division seize the village of Chlum, the key of the position, under cover of a fog and almost without striking a blow. The Austrian cavalry would have given their own infantry time to make good dispositions. Both cavalry and artillery nevertheless devoted themselves till the end of the day to covering the retreat of the infantry.

At Vionville, as we have seen, the charges of the Rheinbaben Division and the Guard Dragoons gained time for the German reserves to arrive on the field.

We cannot pass over in silence the heroic attacks, all sacrifice and devotion, which the French cavalry made at Woerth and Sedan.

On the other side, at Sedan also, the Prussians sent a cavalry division over the Belgian road, thus denying to the French this line of escape.

Finally, the last war in the East, 1877–78, saw General Gourko with his cavalry cut Osman Pacha's lines of supply towards Sofia, after the fights at Telis and Gorni-Dubnik, while the Roumanians intercepted them towards Rachowa. But the most interesting episode of all this campaign regarding the employment of cavalry, if not as independent at least as principal arm, was the famous expedition of General Gourko beyond the Balkans in the valley of the Tundja. This expedition exemplifies in a most striking manner the system of exploration on a large scale and furnishes an excellent illustration of the results that may be obtained in our day with mounted troops, when led with that cool courage which forms the essential quality

of the spirit of enterprise. It started a few days after the passage of the Danube. The Russian army, which had met with some delay, finally advanced in a brilliant fashion and saw fall before it the two imposing barriers which had protected Turkey so long and so effectively against the invasion of her powerful neighbors. The excitement was great in the political and military world. "A river can be crossed always," said they, "but the Balkans also, and without losing a single man! that seems marvellous." "I do not know of an expedition more brilliant or more happy in its results," wrote the correspondent of the *Daily News;* "the raids of Stonewall Jackson must now take second place."

Much allowance must doubtless be made for the hasty estimates of eye-witnesses who wrote under the excitement of the moment, but it is nevertheless true, that the importance of the results obtained by General Gourko was so great that the question was seriously considered whether the general staff should not seize this opportunity for playing a great part and end the war at a blow.

The object assigned to General Gourko's enterprise was however very modest when compared with the results obtained. The orders directed him to proceed towards Tirnova and Selvi, reconnoitre all the surrounding country and prepare the way for an ulterior offensive movement. On the receipt of further orders from the commander-in-chief, he was to advance and try to force the passes of the Balkans. Under cover of his detachment, the pioneers would endeavor to prepare the Balkan passes for the trains and convoys.

The troops under the command of Gourko comprised at first 8000 men and 4000 horses, later, after the arrival of the first brigade of the IX. Division, they amounted to about 12,000 men and 4000 horses.

The expedition occupied a period of three weeks, and the Russian troops, after having gained the Balkan passes, victoriously overran the valleys of Tundja and Maritza and spread terror to the heart of the enemy's country, finally evacuated Roumelia and reëntered Tirnova only upon the advance of Suleyman-Pasha's army, which had been transported in all haste from Montenegro to Adrianople and Hermanli. They had besides delayed the concentration and movements of the Turkish forces.

The losses of this corps amounted to 34 officers and 947 men, losses largely compensated for by the results obtained.

VI.

After all, then, if the action of cavalry in large masses on the field of battle has changed and lost its tactical importance, cavalry combined with the infantry division will find frequent opportunities for success, and its action will be as useful and important as in the past.

We insist very particularly on this point: It is on the battle-field alone that the rôle of cavalry in large masses has diminished, for, before and after the fight it will always play the most important part; and considering the entire service rendered, we can assert that its importance as an arm has increased.

Indeed, from the beginning of war it will cover the mobilization and

concentration of the army, prevent irruptions of the enemy, strive to surprise the secret of his operations, take possession of the points of important passage and destroy or render useless such means of communication as facilitate his movements.

When the army advances, the cavalry reconnoitres, screens its march, watches over its security and grants it repose. After the battle cavalry completes the rout of the adversary, prevents his reforming, allowing him neither truce or respite. It retains contact with the enemy and thus furnishes the general with information concerning the direction followed by the principal columns which it seeks to precede at important defiles.

If, on the contrary, the army to which it belongs has been beaten, cavalry protects the retreat and masks the movements of the main body by its own.

The late General Guillaume, Minister of War in 1870, thus expressed himself in the Chamber of Representatives a little after the Franco-German war :—

"Cavalry is very far from having diminished in importance, the rôle which it has just played in the late war proves this conclusively. While it may be true that we can no longer demand brilliant charges of cavalry, except under special conditions; on the other hand, it is the force, activity and mobility of this arm which assures the security of the army and contributes greatly to the success of the campaign.

"After the war in Bohemia, Prussia considerably increased her cavalry. We know how she turned it to account during her campaign in France where the Uhlan has become a kind of legendary trooper.

"Cavalry covers the front of the army, takes upon itself the duty of making surprises and reconnaissances without which there can be no operations of war. The German cavalry formed a screen on all sides which concealed the movements of their own army and, at the same time, gave timely warning of those of the enemy. In a country like our own, where the frontiers have an immense extent proportionate to the surface of the kingdom, the necessity for cavalry is evident."

The manifold duties which cavalry performs outside the battle-field, and of which we have just given a brief account, sufficiently prove its importance. An army which does not possess cavalry in adequate numbers will be exposed to surprises and will rarely obtain decided success. Without cavalry victory remains, if not fruitless, at least without great results. If, then, we repeat, the action of cavalry on the field of battle has been restricted, it will prove a fatal error to suppose that this arm will no longer play a part in the future. We acknowledge, certainly, that the formidable armament of the infantry, the power of the artillery, and the broken ground which is now sought for combat, all contribute to render the rôle of cavalry more difficult than before. Occasions when it can rush into the thick of the fight will be rarer, but notwithstanding all this, the opportunity will yet occur for sacrificing itself for the good of all.

Thus, in the defense of a position, we must resort to cavalry for gaining those much needed minutes during which the shaken, exhausted infantry can recover breath.

Indeed, when towards the end of the preparatory period for assault the assailant has silenced the defense by his rapid fire, the latter cannot make a counter-attack with his infantry, for the enemy is as yet too far away for such an attack to succeed. A moment of respite is however necessary to the defenders, and cavalry alone can procure it for them by a sudden rush which may delay the assault and bring about a victory on their own account.

On the offensive no arm has the same value for completing the rout of troops which have abandoned their position. At the beginning of an action, cavalry forms a screen behind which the dispositions for attack are made. It is this arm which chases in the outposts and allows the artillery to approach near enough to render its fire effective.

Conversely, on the defensive, cavalry drives back the enemy's troopers, prevents reconnaissance of the position occupied by their own force, obliges the enemy to make a premature deployment and thus delays his first preparations while permitting their own troops to complete their means of defense.

The rôle of cavalry is then an important one; its field of action is so extensive as to be without limits, so to speak; its task is full of difficulties and cavalry cannot overcome them unless granted a large independence.

In the course of the various duties demanded of this arm, it will be forced into fighting troops of all kinds, whether united or separate, and will often be embarrassed if it has no artillery with it. Otherwise, in a wooded country covered with obstacles, such as trees, defiles, ravines, fences and villages, it would be stopped at each step by a few sharpshooters and finally obliged to give up its mission. Artillery must be supplied then, and in order not to retard movement, this artillery must be as light and mobile as possible, in other words horse-artillery and batteries of machine guns. With these powerful auxiliaries it can dare anything. Often, after these combined forces have driven back the opposing cavalry, they will take position on the enemy's flank or lines of communication by great turning movements, and force him either to reveal his position or to fight hastily in retreat.

VII.

We have nearly arrived at the end of our study, but since these pages were written a new agent has appeared to modify the conditions of application of tactical principles.

Tactical rules are unchangeable, only circumstances vary the application of them. The advent of smokeless powder is about to prove this once more to us.

The first question which naturally presents itself to our minds is this:—In the preliminary actions of an offensive battle, can cavalry still fulfill the rôle which the theory of war assigns to it?

It would be puerile to deny that, henceforth a cavalry charged with reconnoitring an adversary in position, will run against serious obstacles. Invisibility and the great effective range of infantry fire will prove the stumbling block against which its efforts will fail. Shots received at the same time on different sides from a hidden enemy will throw the scouting parties into disorder and cause them to retire, usually, without being able to obtain

any precise information. Perhaps officers' reconnaissances may have some chance of success.

Let us see what so high an authority as Prince Hohenlohe thinks on this subject.

"I admit," he says, "that cavalry will sustain greater losses than formerly, and in order to compensate for these losses, they will be obliged to send out a greater number of patrols; but the general principles of exploration, that is to say, the methods of discovering the movements and strength of the armies and corps, have not suffered modification.

"Follow the reports of the different chiefs of patrol in the work of the General Staff, you will find that their points of observation were from 4 to 8 kilometers from the enemy's masses, which they saw perfectly well.

"They will always find elevated positions from which they can see troops on the march or in bivouac even several miles away, for the position of large masses on the march or in bivouac cannot be concealed.

"When the commander knows the approximate strength of the enemy's masses, the place where they have bivouacked, the direction of their march, he can determine in what condition to expect them the next day, as we learn from the history of the 1870 campaigns from St. Privât to Sedan.

"But it becomes of the highest importance that the chiefs of patrol should know how to orient themselves, that they draw up faithful reports, that they learn how to estimate the enemy's strength and the direction of his march, and that they have good field glasses. In 1870, near Sedan, on the heights of Villers-Cernay, I could distinguish with my field-glasses, very ordinary ones, the troops of the Crown Prince issuing forth from the defile of St. Albert near Floing and St. Menges. The distance was four miles."

It may be interesting to read the opinion of a German author, a warm defender of our arm, as a reply to the pessimists who fancy they see in the improvements of fire-arms the certain early decline of cavalry.

"Cavalry screens military operations. The opposing cavalries thus come into contact before the other arms. They mask their respective armies and form a curtain before them which only the fight can pierce. Cavalry which has gained the advantage can inform its own troops while pursuing the others, and can send back reports concerning their strength and position. A few battalions of skirmishers and batteries of artillery can be united with the cavalry for this purpose, but the latter arm will play the principal rôle and the action of magazine rifles will not change the conditions. The skirmish fire of the battalions will certainly create a screen behind which the beaten cavalry can reform, but that will not prevent the other side from turning an exposed flank while the two skirmish lines are fighting.

"We cannot do without cavalry. It is the eye of the commander and is going to see notwithstanding the progress in fire-arms. It should act by masses united by patrols. These masses should be strong enough to possess a sufficient shock action and be adequate to their task. Detached divisions of infantry will have too little mobility to oppose them, notwithstanding their rapid fire weapons. Only the enemy's cavalry can make successful opposition in this period.

"The army whose cavalry has obtained the advantage marches against

a blind adversary and forces him to fight in unfavorable positions. But cavalry only furnishes general information. It is necessary that the columns march with what may be called their feelers, thrown out. These preserve them from the danger of suddenly encountering the enemy's advance guard, from having their communications cut and from other accidental hindrances.

"For purposes of detailed reconnaissance, regiments of detached cavalry are necessary. These enter into the composition of the corps and of the infantry divisions. Formed into a net-work of patrols, they extend on all sides as feelers of the great tactical organism.

"This net-work coming in contact with infantry will find itself unfavorably situated. But we do not ask it to gain a tactical success. It suffices if it causes the infantry whom it screens to know that the position is occupied by the enemy. Cavalry will steal about the flanks seeking information regarding the strength of the force encountered. Evidently this service cannot be performed without losses, but we believe, that even with the new weapon, the sacrifices will not be out of proportion to the results obtained. The losses will not be so terrible as we might suppose at first sight. Even if the patrols do endure one or several volleys, they will not lose time and can get away rapidly. They have proven the presence of the enemy and performed their part, and have only to hasten back to warn the others. The bravery of the men and quality of the horses will evidently prove of great value. The trooper should be convinced that all bullets do not take effect, even with the new powder, and that this powder does not render reconnaissance more difficult but calls for the utmost adroitness in its execution.

"During all this period the infantry patrols, by reason of their slowness, cannot supply the place of cavalry.

"Continuing the subject: All information attests the presence of the enemy. The advance guard commence to skirmish, the artillery opens fire, the masses deploy, in a word, the battle takes place. From this moment, according to the opinion of some people, cavalry has nothing more to do. It is evidently madness to throw cavalry against an unshaken adversary.

"To be sure cavalry will not be an active participant, continually, during the fight. The chief must choose the opportune moment. Once the infantry becomes engaged, cavalry will retire on the flanks and await a favorable occasion for action, which the chief must seize without always waiting for the orders of the commander, however much he may be within reach of his orderlies. He can either take advantage of a moment when the opposing infantry are out of ammunition for accomplishing their defeat, or can sacrifice his own command in order to sustain his infantry whom he sees, shaken and hesitating, about to fall back. Finally when the enemy sends in his reserves to complete his success, the chief can by a counter-attack make a diversion which may give the victory to his own infantry. Cavalry will certainly sustain losses; but will not the artillery lose also? In any case the condition of success lies in the employment of masses. If the first three echelons are stopped by the infantry, the last three will break through and charge the defenseless artillery, which will fall into their hands.

"This can only happen against shaken infantry and cannot then be undertaken without serious risks, but modern history shows that cavalry losses are insignificant under such circumstances compared with the results obtained. What were Bredow's losses at Vionville compared to the advantages gained for the assault of the Prussian infantry?

"Some think that the new powder causes cavalry charges to pass into the realm of mere fancy, because the curtain of smoke will no longer prevent infantry from annihilating charging cavalry. But the absence of this smoke curtain also increases by a hundred per cent. the moral impression of the charge, and this moral effect cannot be destroyed either by skillful control of fire or by its accuracy. Much coolness is necessary to profit by all the advantages, and at this critical moment, coolness will not be easy to maintain.

"Finally, cavalry, much oftener than heretofore, will have to deal with troops which have expended their last cartridges.

"If cavalry had depended so much on improvements in fire-arms, it would have lost all right to exist twenty years ago; but as the human soul is superior to matter, there will still occur moments when no infernal machine can stop a charge of energetic cavalry properly led. It is a matter for remark, however, that during the last great wars there has been no employment of cavalry in masses. Many people rely upon this fact to prove that the value of this arm has been diminished by the progress in other directions.

"The opponents of cavalry do not deny the important part which it plays in pursuit, and to this it will contribute more greatly than ever before. It is evident that with the new weapon, the infantryman will rapidly exhaust his cartridges, notwithstanding a very severe fire discipline and well managed ammunition supply. The soldier will hold his own so long as his cartridges last, but when these are gone, a charge of cavalry on the flank will put him to rout and cause disaster. At such times the absence of smoke will aid cavalry by enabling it to judge ground better and to direct its charges on the most shaken points. It will then have to deal with the adverse cavalry before attacking the infantry. Hence it will be well to have all the cavalry in hand, so that one portion may charge the opposing cavalry and the other the retreating infantry.

"To effect this each cavalry division should be sufficiently strong to admit of separation into two parts, each one of which can act in masses. The enemy's cavalry once repulsed, the results of pursuit become enormous. Thus at Wissenbourg and Woerth, an energetic pursuit by the Germans would have caused the destruction of the French army. But their cavalry was not within reach of orders. Frederick the Great and Napoleon indeed decided battles with cavalry alone.

"But it must be employed in masses. If this principle applies to the other arms, still more should it apply to cavalry."

What more can we add to so complete a picture of the cavalry rôle of to-morrow? Has not the new powder increased the force of the three arms? Has their relative value changed? We do not think so; for, without mentioning the fight on foot, which, by reason of these new improve-

ments in weapons, leads to new successes; whatever means may be adopted in the struggle, it is, after all, the man who employs them who must be most taken into account, and we may add in all confidence, that so long as the instinct of self-preservation remains his most marked characteristic, so long as the sudden appearance of danger operates on the nervous nature of man, so long as symptoms of disorder and moral disturbance manifest themselves at critical moments, so long will cavalry charging in closed ranks preserve its importance and original value.

"Hitherto," writes the German author already quoted, "the smoke, by hiding from the infantryman the storm which has burst upon him in the shape of a cavalry charge, prevented him from breaking. Now, as the smoke exists no more, the infantryman, when charged, will be so much the more shaken at the sight of squadrons rushing upon him at a gallop, that he will shoot wildly, very wildly, if he does not give way altogether."

"With the new weapons," wrote Colonel Ardant du Picq, twenty years ago, "the rôle which has changed the least is that of cavalry, and yet it is the one about which we trouble ourselves the most. Yet cavalry has always the same *credo*, the charge. From the cavalry of one period to that of another, the rôle remains the same.

"Cavalry can only affect infantry surprised or in disorder, and it knows how to set about it."

Some assert that cavalry has lost its place in battle under present conditions. But does infantry succumb to these conditions? Since the improvements in weapons, does the foot soldier march any the less under fire to the attack of a position? Is the trooper of different make up? Has he less heart than his brother of the infantry? If the one marches under fire, cannot the other gallop under the same conditions? The day when it becomes impossible for the trooper to gallop under fire will see the end of marching under fire by infantry, and battles will degenerate into an exchange of volleys at long range between ambushed men. The fight will end only with exhaustion of ammunition.

VIII.

At various periods doubt has been thrown upon the utility of mounted troops, and that which happens to-day in this regard is by no means peculiar to our epoch.

Pretense is made that the rôle of cavalry has lessened in importance only for the purpose of diminishing its numbers, on the claim that it is costly and can be used but little, but mainly because it is costly—a purely economic question, the product of peace conditions.

The command of cavalry on the battle-field requires decision and rare fitness. Resolute bravery and impetuosity, united to prudence and coolness—a difficult combination—are necessary qualifications. If then, cavalry does not show that it is of value, the fault lies not with the rank and file, but with the chiefs. Do not forget, that each time the generals of an army have proved of indifferent quality, the cavalry under their orders have declined in value. It has again risen in estimation and attained its greatest usefulness in the hands of great captains. Under Gustavas Adolphus,

Charles XII, the great Condé, Turenne, Maurice of Saxony, Frederick II, and Napoleon cavalry gained successes, of which, under other chiefs, it no longer seemed capable.

War, that sublime art, that constant application of moral and intellectual faculties, is not going to be entirely subject to every change in material progress. If cavalry had become useless, Frederick and Napoleon would have found it out, for they possessed genius for war to a degree never surpassed.

The experience of the past, the science of the present and the forecast of the future, contend successfully in favor of cavalry, and permit us to hope that it will still find occasion to play an effective part, not alone before and after a battle, but during its progress. This part will be difficult, not impossible; and since we cannot develop the principal element of our arm, the horse, beyond a certain point, we must perfect our manner of using it.

We must endeavor to satisfy the requirements of modern war by a more complete instruction of both man and horse, by the development of the intelligence and initiative of the men, by the manner of breaking and training our horses, and finally, and above all, by the physical, moral and intellectual development of the officers. We must have a corps of unusually endowed officers in every respect, to lead cavalry in time of peace, in order that they may be all that they should be in time of war. Devotion to duty, physical and moral vigor, intelligence and technical instruction, these should be the qualities possessed by the true cavalry officer.

The command of cavalry masses should only be granted to chiefs who are not alone capable of inspiring confidence and enthusiasm, but who, still convinced of the greatness and possibility of the cavalry rôle, are resolved to play it at any cost, persuaded that the moment for action is essentially fleeting and that in order to seize this moment, it is necessary to be bold rather than prudent.

Everywhere to-day, they seem to be going about this work in the right way; in order to employ great masses of cavalry in battle, they study general principles, rules and formations which are the subject of practical exercises and which are constantly developed by means of experiments made during manœuvres. In some states they have already formed great units of cavalry such as they will produce before the enemy.

The dominant thought is to discard the erroneous ideas which exist regarding the employment of cavalry in battle, and to instill principles capable of assuring success, not only against the opposing cavalry but against the other arms as well.

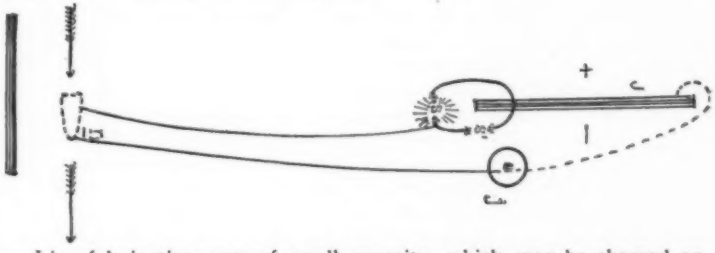
The true tendency of cavalry then, is to recover its place on the field of battle; it will attain this object, we do not doubt. But whatever may be the part which cavalry will have to play in future wars, however scientific its tactics may become, whatever improvements may be applied to the engines of war, cavalry will be more necessary than ever. It will always be required in action, and if each arm is necessary, if each has a glorious part to play, that of cavalry will be to day, to-morrow, as formerly, to fall upon the enemy bravely without counting numbers.

Military Notes.

THE PHOTOGRAPHY OF FLYING BULLETS.*

(From the Royal Engineers' Journal, Oct. 1, 1892.)

THE method hitherto ordinarily followed for photographing flying bullets has been to illuminate the bullet for an instant by means of the electric spark, or rather to cause it to pass in front of a background which is so illuminated for an instant, and to use a camera with a photographic lens to throw an image of the projectile on the sensitive plate. A plan has recently been introduced by Professor Boys, of the Royal College of Science, which enables better results to be obtained with simpler apparatus. An electric spark is caused to pass at the proper instant between suitably-placed terminals, and a shadow of the bullet is cast on the plate. At the same time the atmospheric phenomena of waves and eddies are clearly depicted on the plate. No lens is employed. The following diagram shows the general arrangement:



J is a fulminating pane of small capacity, which may be charged on its two sides + — by means of any kind of friction or induction machine. This pane is allowed to discharge through a very short circuit with two gaps S S′ in it. The spark at S is allowed to shine on the photographic plate at the foot of the diagram without the intervention of lenses of any kind. The spark at S′ is hidden. A second condenser *j*, of very small capacity compared with the pane J, is connected to the latter, one coating by wire, as shown by the full lines, and the other by wet string, as indicated by the dotted line. Its coatings, therefore, till the time of discharges arrives, are kept at the same potentials as those of the pane J. The discharge circuit of the little jar *j* includes the gaps S′ and *n*. The potential

*. ompiled by Capt. A. M. Mantell, R. E., from the Journal of Transactions of the Photographic Society of Great Britain.

is so chosen that neither condenser is able to discharge across the two gaps S S′ or *n* S′, as the case may be, but that either would go off if either of its gaps were made conducting. This is effected by the passage of the bullet across *n* which immediately causes a feeble spark at S′, due to the discharge there of *j*. The wet string acts as a conductor during the process of charging J and *j*, while it acts practically as an insulator during the discharge of *j*. The air at S, being now conducting no longer, prevents the pane J from discharging across the gap S, the spark, therefore, is produced which casts a shadow of the bullet, and in effect an image of any atmospheric phenomena accompanying the bullet upon the photographic plate.

The advantages secured by this arrangement may not at first be apparent. The difficulty in photographing bullets is to obtain a spark which, while it is bright enough to act on the plate, is yet of such short duration that the bullet has not time to move more than a hundredth of an inch or less while it is yet in existence. If glass lenses be used, a large proportion of the actinic rays are absorbed—in the case of a spark between magnesium terminals four-fifths of the whole—while if no lens be used the whole of the rays (except such as may be absorbed by the air) are effective.

When a lens is used, the spark formed by the bullet at *n* is properly focussed by the lens, and does not interfere with the result. In Professor Boys' shadow method, however, any spark at *n* being near the plate would (unless it were very feeble) fog the plate so completely as to make the distant spark at S almost, if not quite, inoperative.

This difficulty is completely avoided by the use of the jar *j*, of very small capacity, which is unable to produce a spark of any appreciable photographic effect. Moreover, the spark at S is brighter. and should last less time when a very short discharge circuit is employed than the corresponding spark produced in the discharge through a greater length of wire ; such, for instance, as would be necessary if the main discharge were taken to the bullet and back. Again, any attempt that might be made to increase the photographic power of a spark either (1) by bringing it nearer to the plate, or (2) by making it longer, and therefore, increasing the potential before discharge ; or (3) by increasing the capacity of the condenser, would lead to a loss of sharpness in the shadow, for in either (1) or (2) the penumbra would obviously be increased, while in (3) the duration of the spark would be greater, and therefore the bullet would move a greater distance during the discharge. The arrangement shown in the diagram reconciles these formerly incompatible conditions, for Mr. Boys has found that by the use of a second hidden gap in the discharge circuit, he is able to increase the brilliancy of the light from an exposed spark gap of constant length in a very high proportion, in one case eight fold, while, theoretically, such a spark ought to last less time than a spark in a circuit without an extra gap. Photographic photometric tests have been made on this point, but an account of these and a number of experiments on sparks made under a variety of conditions and in different ways, with a view to test their suitability for the special purpose, would occupy too much space. There is not as yet any direct experimental evidence that the spark made with the double gap does last less time than that with a single short gap, but exper-

iments that are now being conducted in which observation can be made to about the one hundred-millionth of a second will shortly be completed, and will most likely throw some light on this point.

* * * * * * *

Very little need be said of the details of the apparatus, which is of the simplest possible character. It consists merely of an old packing case, with a large centre-bit hole on either side, into which paper tubes, blackened inside, are fitted. These are covered at the end with the black paper, so that when the bullet passes through very little light can enter the box, and what does will not fall upon the plate. Hinged shutters to fall down and close the apertures made by the bullet are quite unnecessary. The wire contacts are important. If even thin copper wires are used, the first one hit is apt to be shot away before the bullet meets the other, unless the first one is only brushed at a grazing incidence. Mr. Boys has found that very fine lead wire, most easily produced as required by drawing melted lead into a capillary glass tube, is never shot away or even bent; it is perfectly sheared off by the passing bullet. This is a detail which practically insures the success of the process. When both wires were copper, there was no certainty that the photograph would show the bullet; in some cases the bullet had just escaped, leaving the atmospheric trail only to be photographed.

It does not appear that much depends on the photographic plate used. The earlier photographs were taken on the ordinary Ilford plate, developed with pyrogallic acid, but for those taken later, under the advice of Mr. Chapman Jones, Thomas's cyclist plates and eikonogen developer were used.

* * * * *

The spark was about one-eighth of an inch long, and about three feet from the photographic plate. He should, perhaps, have said that if the object were to get a very sharp photograph of the bullet itself, then all that had to be done was to let the bullet pass about half an inch in front of the plate; but if the atmospheric phenomena were to be seen conspicuously, it was best to put the bullet three or four inches from the plate. The distance the bullet travelled was about twelve feet. As there was not the slightest difficulty in shooting two or three times the length of the room so accurately that the bullet went in the same hole every time, traversing exactly the same path, there was no difficulty in photographing it at any reasonable distance from the weapon. Nor would there be any great difficulty in photographing a bullet, say for the first thirty or forty yards, every six inches or a foot on its way. It would, however, involve a great deal of trouble, and inasmuch as up to the present time no one, as far as he knew, wanted to know the results, he did not think there would have been up to the present time any purpose in taking the trouble. In the experiments detailed, he had not really been attempting to solve any problems, his only object was to develop a method which in the hands of those who were practically concerned, might be of some assistance. All the photographs, except those of the pistol bullets, had been taken in broad day-light, and he hoped he might be able at Woolwich, at some future time, to make corresponding experiments with larger guns. A box, or room, of suitable dimensions,

could easily be placed in the path of the projectile, which could then be photographed—using a plate, of course, of proportionate size.

NEW PATTERN CAVALRY SKETCHING CASE.

(*See* JOURNAL *No.* 54, *p.* 1247.)

Major Verner's new pattern Cavalry Sketching Case is a distinct advance on that brought out by him in 1887, and which has been so largely used in England and abroad. The rollers carrying the paper are no longer clamped by turning screws. This process has been found unsatisfactory, since it was at times impossible to regulate the degree of required rigidity, and the rollers when unclamped were liable to run too free. In the new board, the action of the rollers is controlled in a simple and thoroughly effective manner, so that there is always a strain on the paper, which latter is in consequence always rigidly stretched across the board, presenting a perfectly smooth surface. The rollers are turned by means of small thumb-pieces at the ends, a system which is far more convenient than that hitherto employed. The straight-edged ruler working under elastic bands is replaced by a ruler working at the end of a short arm pivoted to the board, and so arranged as to admit of universal motion in the plane of the board. All clamping screws, slotted rulers, slides, etc., are done away with, and the ruler is made sufficiently rigid by an arrangement similar to that employed for the rollers. At the back of the board a good clinometer is fixed, the metal plumb bob of which is released or clamped by pressing a spring. The board is supplied with the various scales, etc., which experience has proved to be most generally useful.

Major Willoughby Verner has invented a new ingenious Traversing Pencil. This is a pencil case holding an ordinary cedar pencil, and provided at one end with a small metal wheel, carrying teeth at regular intervals, say one-eighth of an inch apart along its pedimeter. Every fourth tooth is cut so as to register differently to the intermediate ones. A second small wheel with a broad truck is fixed to the pencil case about an inch from the toothed wheel. When the pencil case is held with the two wheels resting on a sketching board, the pencil is inclined at about an angle of 20° to the surface of it, and the direction of any distant object can be accurately taken by running the instrument along the paper in its direction. The course taken by the pencil is marked on the sketch by a series of small dots, and thus the required direction is recorded. The distance can be marked in when ascertained by taking every space between two dots, to represent some convenient distance, such as 25 yards, in which case every fourth dot would represent 100 yards, and a sketch on a scale of 200 yards to an inch would be made. The broad trucked wheel causes the pencil to run true in the direction first given to it. This is particularly valuable when sketching on horseback, for the directions of distant objects can be rapidly taken by pressing the pencil on the board and running it along the surface. All who have used the Cavalry Sketching Case have experienced the inconvenience caused by a horse moving before the triple process of aiming the ruler on an object drawing in the line, and marking off the distance from a scale, have been concluded.—*Army and Navy Gazette.*

A NEW MANNLICHER RIFLE.

In military circles at Vienna it has been known for some time past that Herr von Mannlicher, the inventor of the celebrated repeating rifle of the Austrian army, which bears his name, has completed a new weapon whose "fire results" are amazing. Some strictly confidential trials of the new rifle were made in August last by the musketry experts of the Austrian army, but no one else was permitted to test or even examine it. The reports of the Austrian experts are, Reuter's agent is informed, satisfactory in every respect, and he is in a position to describe in detail the weapon and its capabilities, having been afforded an opportunity to inspect and test it at the branch establishment in Währing of the Steyer Small Arms Manufacturing Company. There is nothing particularly striking in the outward appearance of the automatic repeating rifle. It possesses the ordinary characteristics of the various repeating systems now in use. The beautifully finished models shown me, however, were somewhat shorter than the latter, their dimensions being about those of an ordinary carbine, and their length 40 in. The weight, so important a factor, is slightly under that of an ordinary repeating rifle. Its bore is 6.5 millimetres in diameter, the same as that of the latest Mannlicher pattern, adopted by the Roumanian and Italian Governments. Compared with the British Lee-Metford's 7.8 and the former Mannlicher's 8 millimetres, this is, indeed, a considerable reduction of bore. But the inventor favors the smaller size on account of the increased velocity obtained and the reduction in the weight of the cartridges. The weapon is sighted up to 2700 yards, point blank to 500, with the "culminating point" in the latter trajectory at 5 ft. from the ground. The back sight is of the ordinary "leaf and bed" shape, but with its bar adjustable by pressure of the thumb of the left hand, even while the "leaf" is lying down. The breech action is inclosed, and guided in a cylindrical tube called the breech receiver of a similar diameter to the barrel in its outside coverings.

The mechanism of the rifle consists of five essential parts, simple in detail and strongly made. First, there is the barrel containing the cartridge chamber; second, the locking lever, attached to the lower part of the barrel immediately underneath the cartridge chamber, and serving to engage and hold firm the third part, that is, the recoil and spring operated breech-bolt, when the cartridge is pushed home; the fourth part is the breech-receiver already mentioned; and, lastly, there is the trigger mechanism, which is so constructed that the shots may be fired in the most rapid succession or at any desired intervals. The mechanism, therefore, is simplicity itself.

With regard to the new weapon's performances, there was no space at our disposal at the works for long-range firing. But we descended into a big underground vault and fired bullets, or rather poured them, into sandbags piled up against the base of a section of the huge fortification wall that was thrown round Vienna by Prince Eugene early in the eighteenth century. Herr von Mannlicher fired first, to show me the handling of the rifle. The method of loading is the same as that practised with the ordinary Mannlicher repeater in Germany and Austria—viz., the sure and practical "clip," containing five cartridges pressed downwards into the magazine

exposed to view when the breech-bolt is drawn back. A touch of the trigger of the automatic repeater, and the breech-bolt flew back into its closed position. Then followed five piercingly-sharp explosions, and the empty clip dropped ringing from the magazine on the floor. The explosions seemed instantaneous. With a stop-watch I timed them and found that they occupied a single second. Barely one-and-a-half seconds to come down from the "present" to the "ready" position, to insert another clip, and then five more shots banged forth in the same limit of time. No cartridge jams. The mechanism is too sound and simple for that.

I took the automatic wonder in hand, and in a space of time which may be counted by seconds, blazed away a sufficient number of rounds to have kept me busy for an afternoon on a Middlesex rifle range with the regulation Martini. There is no more recoil than in the case of a rook rifle. The mechanism seems to absorb the "kick." The breech-bolt flies backwards and forwards at every discharge, ejecting the used-up, smokeless-powder cartridge, and pushing home a fresh one from the magazine. The eye cannot follow the movement, so instantaneous does it seem. And there is no escape of gas. In the hands of its inventor the rifle can discharge about 120 rounds per minute. The barrel becomes hot, but not so hot as to render the rifle useless for a time. When at the "present" the left hand is protected from contact with the barrel, and no inconvenience is therefore experienced. The rapid and powerful movement of the breech-bolt during action counteracts the jamming influences of sand and dust. Should the exceedingly simple mechanism for automatically operating the breech-bolt become deranged the rifle can still be used as an ordinary repeater.

According to Herr von Mannlicher, his automatic rifle is not at the present time suited for general use by infantry on account of the difficulties still encountered in supplying ammunition to the rank and file on the field in quantities sufficient to satisfy the demands of this cartridge-swallowing weapon. It might, moreover, be a risky experiment to place in the hands of a soldier a rifle that can easily expend in one minute 100 rounds out of the supply of 150 that he carries in his cartridge pouches. Herein lies a serious difficulty, for every one knows how apt soldiers are to lose their heads and "blaze away." On shipboard, however, when, for instance, sailors on an ironclad had to repel a torpedo boat attack, the rifle is expected to prove extremely serviceable. The men could, with plenty of ammunition lying beside them, pour out bullets like a hailstorm. The rapidity of the fire will be still further increased when the rifle is fitted with a magazine holding eight rounds, an alteration which Herr von Mannlicher intends to introduce.—*The Army and Navy Gazette.*

PROFESSOR HEBLER ON THE BEST POSSIBLE FORM OF BULLET.

In the *United Service Gazette* of August 20* we gave a summary of Professor Hebler's contribution to the *Allgemeine Schweizerische Militär-Zeitung* on "The Employment of a More Suitable Ogival Head for Projectiles, and the Advantages to be Derived Therefrom." In a second

*See JOURNAL No. 60, p. 1245.

contribution to the same paper Professor Hebler sets himself to show that almost equally important advantages can be secured by suitably shaping the rear portion of the projectile. From the experiments which he has carried out he finds that much of the resistance offered by the atmosphere can be overcome by giving the rear of the bullet as long an ogival as possible. Of course, a bullet of the shape proposed would have to be provided with a base cup, so as to ensure its leaving the barrel truly, but the cup would not primarily be used to make the bullet take the rifling. The base cup should be made out of some light but sufficiently tough material—such as *papier-maché* or specially prepared india-rubber—which would not set up more than just enough to completely fill the bore; the principal rotation being imparted to the projectile by making the middle of the bullet slightly larger than the size of the diameter of the bore between the grooves. This middle space, intermediate between the two ogivals, would have a length of 2 mm.; but as a small portion of the thicker ends of the ogivals would also take the rifling, the bearing-surface about the middle of the bullet would be in all about 8 or 9 mm. (about ⅓ of an inch). This by itself would be insufficient to keep the bullet steady, but the slight setting-up of the base cup prevents any danger of the projectile not leaving the barrel correctly. Bullet and base cup, so long as they are in the barrel, must be considered as forming the complete projectile. The base cup, however, drops off within a short distance of leaving the muzzle, and, like the cartridge-case, can be used several times. The whole of the bullet has a hard metallic covering.

For the purpose of carrying out his experiments Professor Hebler had two kinds of bullets made, the first to be used with the German magazine rifle, 1888 pattern, and the second with a rifle of 5 mm. The following are the principal details given of the larger bullet; the words in brackets refer to the German 1888 pattern bullet:—Length of bullet, 32 mm. (the same); length of cartridge, 82.5 mm. (the same); length of the front ogival, 18 mm. (not stated); maximum diameter of front ogival, 8 mm. (not stated); length of the rear ogival, 12 mm.; maximum diameter of rear ogival, 8 mm.; length of central rifling ring, 2 mm.; maximum diameter of ditto, 8.22 mm.; maximum diameter of bore between grooves, 8.2 mm.; weight of base cup, .3 grammes; weight of bullet, 11.4 grammes (14.5 grammes); powder charge, 2.75 grammes, smokeless (the same); total weight of cartridge, 25.1 grammes (27.5 grammes); initial velocity, 700 metres (640 metres); velocity at 1000 metres from the muzzle, 479 metres (253 metres); velocity at 2500 metres from the muzzle, 325 metres (132 metres); maximum pressure in bore, 2400 atmospheres (3300); beaten zone for an object 5 feet 6 inches high at 1000 metres, 125 metres (40 metres); beaten zone for an object 5 feet 6 inches high at 2500 metres, 32 metres (7 metres); maximum of beaten zone for an object 5 feet 6 inches high, 614 metres (438 metres). Deflection of bullet with a side wind of 5 metres:—deflection at 1000 metres, 1.1 metre (2.5 metres); deflection at 2500 metres, 11 metres (43 metres).

Compared with the ordinary German bullet, the improved double ogival-ended bullet has a total ballistic efficiency, or "goodness," of 1347, as against 474, whilst that of the improved ogival-headed bullet referred to in our article of August 20 was only as 784 to 474.

Coming to the smaller 5 mm. bullet, the following are the details given. The words in brackets refer to the ordinary pattern bullet for a rifle of this calibre :—Length of bullet, 30 mm. (the same) ; length of cartridge, 72 mm. (the same) ; length of front ogival, 17 mm. (not stated) ; maximum diameter of front ogival, 5.1 mm. (not stated) ; length of rear ogival 11 mm. (not stated) ; maximum diameter of rear ogival, 5.1 mm. (not stated) ; length of central rifling ring, 2 mm. ; maximum diameter of central rifling ring, 5.3 mm. ; maximum diameter of bore between grooves, 5.22 mm. ; weight of base cup, .12 grammes ; weight of bullet, 4.5 grammes (5.8 grammes) ; powder charge, 1.5 grammes (the same) ; total weight of cartridge, 13.5 grammes (14.5 grammes) ; initial velocity, 880 metres (797 metres) ; velocity at 1000 metres from the muzzle, 616 metres (303 metres) ; velocity at 2500 metres from the muzzle, 425 metres (157 metres) ; maximum pressure in bore, 2700 atmospheres, (3600 atmospheres). Beaten zone for an object 5 feet 6 inches high—at 1000 metres, 199 metres (64 metres) ; at 2500 metres, 64 metres (12 metres). Maximum of beaten zone for an object 5 feet 6 inches high, 766 metres (516 metres). Deflection of bullet with a side wind of 5 metres :—At 1000 metres, 1 metre (2.6 metres) ; at 2500 metres, 10 metres (45 metres).

Taking the total ballistic efficiency or "goodness," of the 11 mm. Mannlicher rifle, 1871 pattern, as a standard, and valuing it at 100, Professor Hebler calculates the "goodness" of the 5 mm. rifle, firing the most favorable form of bullet, at 4020, and classes the value of the results of employing the types of bullets as follows :—German 1888 pattern bullet, 474 ; improved ogival-headed type, 784 ; improved double ogival-ended type, 1347 ; or, if fired from a 5 mm. rifle, ordinary pattern bullet, 1429 ; improved ogival-headed type, 2522 ; improved double ogival-ended type, 4020. In addition to the above particulars, it should be stated that the penetration of the improved double ogival ended bullet into white deal at 1000 and 2500 metres is respectively about three times and five times greater than that of the ordinary bullet at those ranges.—*United Service Gazette.*

EXPERIMENTAL ALUMINIUM HORSE-SHOES.

(Translated from the *Invalide Russe* by CAPTAIN E. LAMBERT, R. H. A.)

In the Finland Dragoons an experiment has been made with aluminium horse-shoes. A few horses were chosen and shod with one aluminium shoe and three iron shoes, the former being on the fore foot in some cases, and on the hind in others. Some of the horses were remounts working only in the school, and others fully trained horses. The experiments lasted six weeks, and showed that the aluminium shoes lasted longer and preserved the foot better than the iron ones. No aluminium shoes broke, and they were used over again for re-shoeing. The horses were worked over hard and stony ground. It had been feared that the aluminium shoes would suffer from contact with urine, and that the shoeing would suffer from the acid products, but this was not found to be the case. To try this fully, pieces of the metal were kept a whole month in urine, but no chemical change took place in them. A very trifling loss of weight was observed.

The aluminium shoes are only one-third to one-fourth the weight of iron

shoes. Their cost is certainly greater, but this is to some extent compensated for by the facts that very little charcoal is required in shoeing, that there is no loss in weight, and that the value of the old metal is the same as that of fresh. In making the shoes some skill is required, as the forging must be done at a rather low but exactly regulated temperature. This also makes the operation a rather lengthy one.

Taking into consideration the importance of light shoes, especially for horses doing fast work, and the advantage of being able to carry a large number of spare shoes on a campaign without increasing the load of the wagons, and lastly the probablity of a fall in price of aluminium, it is safe to predict the general introduction in the future of this metal for the shoeing of cavalry and artillery horses.—*Journal of the Royal United Service Institution.*

RECENT MILITARY ARTICLES OF SPECIAL INTEREST.

Journal of the U. S. Cavalry Association, September.

"The Tactical Use of Mounted Troops in Future Campaigns, with Comments on the Recent Rehabilitation of the Lance in European Armies." By Lieut. George W. VanDeusen, 1st Artillery.

"Cavalry on the Field of Battle." Trans. by Lieut. Geo. W. Read, 5th Cavalry.

"Conversations on Cavalry." By Prince Hohenlohe. Trans. by Lieut. Carl Reichman, 9th Infantry.

"Mounted Pistol Practice." By Capt. George Paddock, 5th Cavalry.

"The Cavalry Horse: Instruction of the Trooper in Drill and the Details of the Service, with Suggestions for their Improvement." By Captain J. H. Dorst, 4th Cavalry.

Journal of the U. S. Artillery, October.

"Electricity and the Art of War." By Lieut. C. D. Parkhurst, 4th Artillery.

"Recoil of Heavy Guns and its Control." By Lieut. Henry C. Davis, 3d Artillery.

"Time Fuse with Shrapnel Fire." By 1st Lieut. A. D. Schenck, 2d Artillery.

"The United Service." By Hamersly.

"Methods of Marching." By Captain H. R. Brinkerhoff, 15th Infantry.

"The Coming Revolution in Tactics and Strategy" (Reprint). By Colonel H. Elsdale.

Journal of the Royal United Service Institution.

"Magazine Rifles, their Latest Developments and Effects." By Captain Walter H. James, late R. E.

"Saddles." By Colonel the Hon. H. G. L. Crichton.

"Cavalry Swimming." Trans. by Captain E. Lambert, R. H. A., September.

"Colonel V. Lobell's Annual Reports upon the Changes and Progress in Military Matters During 1891" Compiled by Colonel H. Hildyard, October.

"German Divisional Cavalry." By Major C. Barter, D. A. A. G., November.

Journal of the United Service Institution of India.

"On Repairing and Constructing War Railways." By J. R. Bell, Esq., C.E.

"The Most Effective Use that can be Made of Signalling on a Modern Battle Field." By Captain E. O. F. Hamilton.

"The Combined Tactics of Infantry and Artillery." By Colonel G. F. Young, August.

The United Service Magazine, London.

"The Coming War." Austriacus.

"Studies in Troop Leading." By Major G. F. R. Henderson. December.

Revue du Cercle Militaire.

Le Prisme-Telemetre Souchier.

Le Statisque Medicale de l'Armée Française en 1890. December 4.

Reviews and Exchanges.

History of the Mexican War.*

THIS account—written by a graduate of '46 entering thus on his maiden duty into the new war, partakes in its whole of the enthusiasm of the author's youth. Though it is a posthumous work, it shows that the General must have kept enough of his notes and diary together to give the smack of the actual actor to the composition.

His account of the origin of the war with the initiatory diplomacy and his review of the Wilmot Proviso hint at a kindly feeling for the old pro-slavery interests that were to be subserved by the annexation of Texas, but it never leads him into the injustice of covering up anything which would bring out the weak points of southern logic. In fact he makes a very full statement of the claims and purposes of the Administration, so far as the Administration and its southern supporters wished to have them considered by the country, and maybe if he had taken the pains to show the opposition to war he would have been less a historian than a polemic.

He is an eminently just handler of subjects where one would suppose his own prejudices would bias judgment. If he has a fault it is that of the optimist. Our great generals were all heroes to him, and he does not go out of his straightforward narrative to point out weaknesses.

Hence the reader must not expect here to find an analytic and professional discussion of campaigns or battles.

Taylor's grand tactics or his plan of campaign resulting in the actions of Palo Alto and Resaca de la Palma are not questioned but, to the general reader, pass on to the *tapis* as naturally as if they were the most complete culmination of a well-ordered foresight.

One can see that the General, as all true soldiers should have, had all his sympathies with Taylor and Scott in their difficulties with Secretary Marcy. The domineering tone of that functionary, without comment from Wilcox, stands forth to-day in cold type more offensively than it did then when men's minds could not be free from a political party bias. It is not difficult to read between the Secretary's lines that these military leaders were feared as gaining a hold on public esteem which might make them successful future presidential rivals. Hence, they must be treated as mere soldier machines to execute the butchering, while the grand strategy was arranged at the White House, and the generals, the keepers of the nation's honor on a foreign soil were to have nothing to say in diplomacy. The support of Scott, nor of Taylor in men, supplies, or arms was certainly not what our country was able to give. Still there is this to say for the Administration, that the war was not at all a popular one, and it behooved the rulers to "run it" as economically as possible.

Returning to the author's admiration for General Taylor, it does not allow him to question the propriety of Taylor's long (aimless, so far as we can see) advance from

*_History of the Mexican War_. By General Cadmus M. Wilcox. The Church News Publishing Co. Washington, D. C.

Saltillo, after the great reduction of his force by drafts from it to Scott's line. It was presumed that Santa Aña would concentrate everything to resist Scott at Vera Cruz. Maybe Taylor hoped to drop down in the meantime on the Capital and forestall Scott: has this been ever said or suggested? It is not here said that he marched off south to find Santa Aña. His movement was against the advice of Scott and of the Administration.

From dispatches that Santa Aña had captured, he formed his plans to beat Taylor, advancing so far from his weakened base, and then to turn back crowned with victory and overwhelm Scott, weakened by the *vomito* of the *Tierra caliente*, at any one of the numerous passes between Plan del Rio and Perote. Taylor on finding Santa Aña's proximity beat a hasty retreat to a defensible ground, Buena Vista (called by the Mexicans La Angostura), and then, leaving Wool with a reduced force to take the brunt of a day's fighting, kept on with a large detachment of his choice troops to put Saltillo in a state of defense. A reasonable fear of his enemy passing to his rear might possibly justify this; but it reminds one of the story of the fancy cat-boat man and the old skipper. Said the first: "Capt'n, got into a blow yesterday, and in trying to get in on a short cut, I got aground. My sail got chocked; if I left the tiller to go to the centre-board I would have broached to, if I had let go the sheet I would have been pulled over anyhow—what would you have done in such a case?" "I wouldn't have got into such a case." "Yes, yes, but s'posin' you had?" "Well, I wouldn't." "Oh, yes, I know that well enough, but just s'posin', you know?" "Can't s'pose it."

Probably we say Taylor acted fairly well in putting Saltillo in a condition of defense, but after a similar mistake at Point Isabel, it is wonderful that such a necessity should present itself at probably the most momentous occasion of the war. Why General Taylor didn't fortify Point Isabel and Saltillo before leaving them is more than mortal man can answer. After Wool was beaten, about 4 P.M. at Buena Vista, and the most exhausted bodies of men, Mexican and American, lay gathering a little strength for the last struggle, Taylor with his detachment of choice infantry and artillery returned and changed the day. A volunteer on Wool's staff, Dr. Johnson, afterward assassinated at La Haya, Mex., told us that in the latter part of the struggle General Wool rode among his prostrate men spatting them with his sabre to drive them into their ranks or to their guns. It was a drawn battle and Santa Aña having failed in his general plan left in the night, hurrying everything back to the defense of the Capital. If Taylor had had designs on that, Buena Vista cured them, and he contented himself with securing his connections with his base.

Wool and Doniphan's expeditions to Santa Fé might have been more fully treated, but there never has been much literature on that subject.

Frémont's story is very fairly set forth, and his management during the Bear Flag movement.

Of course, the grand movements of Scott fill up the greater part of the book, and it smacks, though truthfully, of the romance of Hernando Cortez. Wilcox writes so fairly that the American reader scarcely knows which feeling is uppermost, enthusiasm for his countrymen or sympathy for the poorly armed, poorly organized, but brave enemy, resisting the invasion of their country.

A point that shows the author's admirable self-control is the fact that scarcely a hint discloses any condemnation for the battle of Molino del Rey. We took it at the third charge, but with a "butcher bill," as the army called it, of some eight hundred of our best blood, when it was held that we had guns which would have made the Mill untenable in "no time," but Worth was determined to do something *brilliant*—and he did. We might mention *en passant* that Lieut. J. F. Farry, 3d Artillery, there killed, was in arrest when killed. For some routine trifling delinquency he had been

placed in arrest, but when the advance was ordered he followed his company and, as well as can be recollected, only took command when its legitimate commander was disabled. Then he stepped into the gap and fell, nobly leading. Farry had a marked analytic faculty. He tried to throw every problem into mathematics for solution. He was ever tinkering with the Laws of Chances. The day before the battle of Molino he spoke to Geo. P. Andrews, his regimental- and class-mate, saying: "I have been figuring it out, Andrews, and it is your or my turn to get killed in the next fight." Andrews always admitted afterward that he was very much startled with the solid, self-convinced matter-of-fact way that Farry put it, and then Andrews would add that Death was so satisfied with the noble harvest he had reaped in getting Farry, that he, Andrews, was let off in the subsequent actions.

Farry was a noble soul. There are always a class of plebes at West Point, who, from their frontier crudeness, want of elegance, or some sharp corners in their make-up, are relegated to a disagreeable and even disheartening unpopularity; seldom deserved to the extent that such a punishment entails. When one of these would get into a difficulty that had to be settled by a trial of conclusions, he might reasonably expect to find Farry's hand (even when in his first-class year) laid on his shoulder with the remark almost whispered in his ear, "Plebe, I'll stand by you;" and strange to say his man invariably got the best of it, either at Kosciusko's Garden or in Cock-Loft of the Old North Barracks.

The author gives a fairly full account of the operations of the Navy after the landing at Vera Cruz, of course showing its work at and before that time, and for individual prowess there was nothing done better by the Army.

A fair and full account of the difficulties involving the great commanders—Taylor, Scott, Worth and Pillow, with the Courts of Inquiry—is given.

One must be struck in many places with the eminently fair views of General Wilcox. His having been under the misfortune of a failure before the arms of the afterward Gen'l U. S. Grant in no way perverts his high expressions of esteem for him as Second Lieutenant Grant, and he appears in no way to grudge him the high honors afterwards attained though at the author's loss. The author's constantly speaking of the field guns throwing grape-shot may pardon a professional smile.

It would be desirable that the maps in a future edition should be bettered; to follow them in detail is too great a task for old eyes; they are entirely unworthy of the work. Some of the blemishes that no doubt, had the author lived, would not have appeared are the errors in orthography of many Mexican and Spanish words and names. A valuable Roster of Army and Navy Officers and Volunteers who served in Mexico is appended. There are a number of possibly unavoidable errors in the Roster. Among them, 1. Gen'l Canby was not "killed in action with Modoc Indians." 2. Second Lieut. Norvin H. Goff's assassination should not have been left to be charged presumptively against the Mexicans of Perote; he was killed in cold blood by a Georgian captain whose enmity he never suspected, Hervey. 3. Of the graduating class of 1847, Cullum credits all but two with Mexican service, Wilcox credits but eight.

We cannot say how this old story of the Mexican War may fall on the present generation of active men; it is much obscured no doubt by distance, but still more by the ponderous record of the Great Rebellion. But to an old soldier of that day, it brings the blood tingling to the fingers and gives us a touch of rejuvenation. Wilcox must have kept a good diary to bring out after forty years so much of the minutia of that day—as we said before. Every name brings up a reminiscence, and few, very few, of meanness. Nearly all noble, nobler, noblest, most noblest. Here, on this book, the American can lay his hand and say with pride, These are my countrymen's chivalric deeds, better them who will. J. H.

The Messing of the Soldier.*

This pamphlet gives memoranda, cooking formulas and schedules for the information of company commanders, quartermasters and others, with a view to assisting them to economize the messing of the soldier, to improve the cooking of his ration and to vary and increase his scale of diet.

From it the following is learned :

The messing of the English soldier is a matter of coöperation. The Government furnishing the bread and meat portion only, consisting of one pound of bread and three-fourths of a pound of meat, including bone, per man daily, the soldier being taxed three pence per diem, deducted from his daily pay to supply the remaining portion, the total net cost of the daily ration per man being in barracks 8¾ pence, in the field 9¾ pence, the cost of fuel included.

The messing is by companies, there are no consolidated messes. Commanders submit to the adjutant each Friday a scale of proposed diet for one week commencing the following Sunday, the adjutant consolidates these estimates and submits them on Saturday morning to the commanding officer for his approval, after approval copies are furnished the quartermaster, the sergeant-cook and the non commissioned officers in charge of the grocery bar.

" This weekly scale of diet will enable the quartermaster to regulate beforehand the issue of meat so as to insure joints being reserved for the companies having bakes or roasts, while other portions of the meat can be issued to companies having pies, stews, etc."

The sergeant-cook makes the most effective use of his cooking apparatus, and brings to notice any alterations in the weekly scale of diet necessitated by the available kitchen accommodation.

The non-commissioned officer in charge of the grocery bar carefully weighs and prepares the various articles issued by him, beforehand, to avoid errors.

Three diets are recognized :

" a. Rest diet."

" b. Ordinary working diet."

" c. Active service or hard working diet."

The following are the details of the alimentary principles computed for a man of average weight, viz. : 10 to 11 stone.

Alimentary Principles.	(a) Rest.	(b) ordinary work equal to 300 foot tons 10 mile march (peace scale).	(c) hard work equal to 500 foot tons or 20 mile march (war scale).
	ozs.	ozs.	ozs.
Proteids	2.5	4.5	6.5
Fats	1.	3.	5.
Carbo-hydrates	12.	14.	16.
Salts	.5	1.	1.5
Total weight of water free food	16.	22.5	29

* *The Messing of the Soldier.* Including schedules illustrative of the new system of military cooking, by Lieut.-Colonel Hutton; issued by the direction of Lieut.-General Sir Evelyn Wood, commanding Aldershot Division. Gale and Polden. London, England.

The articles obtainable at the grocery bar are, bacon, baking powders, barley, beans, brawn, bread, butter, cabbage, cheese, cocoa, coffee, currants, curry, dripping, eggs, fish, flour, herbs, jam, marmalade, lemon peel, lentils, milk, mustard, oat-meal, onions, pepper, pepper cayenne, pickles, potatoes, raisins, rice, salt, spice, split-peas, sugar, tea and vegetables mixed.

From a schedule given as a specimen of military diet for one week, it being the diet of an infantry battalion quartered in barracks at Aldershot, for the week ending 30th April 1892, *i. e.*, for fifty-six (56) each, breakfasts, dinners and teas, it is seen that in addition to tea and bread at each breakfast:

16 had butter,
9 " bacon,
5 " fish,
1 " brawn and pickles,
3 " kippers,
3 " rissoles,
1 " sausage,
1 " eggs and bacon,
1 " jam,
1 " eggs,
4 had herrings,
1 " brawn,
1 " dripping,
3 " bloaters,
1 " curried liver,
1 " liver and bacon,
1 " cheese,
1 " haddock,
1 " golden syrup.

Of the dinners, in addition to bread, there was supplied meats as follows:

29 baked or roasted beef,
13 stews (assorted),
5 meat-pies,
3 steamed meat,
2 Turkish pillau,
3 curries,
1 toad-in-the-hole.

Forty-six (46) of the dinners furnished desserts, principally puddings, potatoes were supplied at 54, beans at one, peas at one and at 5 haricot beans were furnished in addition to potatoes, ten only had soup and of these only three had dessert.

At the teas in addition to bread and tea:

15 had butter,
15 " dripping,
13 " jam,
5 " marmalade,
3 had golden syrup,
1 " pickled herring,
1 " water cress,
3 " fish.

In the field, for breakfast, tea is replaced by coffee and the addition of either beef, liver, eggs, bacon or curries is made at an increase in cost of 1 penny per day; the dinners and teas are essentially the same as in barracks.

The author impresses one as being thoroughly conversant with and deeply interested in his subject; he gives prominence to the stock-pot and dripping-pan and their products, as factors of the greatest importance in securing the results named as the object of his pamphlet, since by means of these utensils every particle of the natural fat of the beef is made use of as good food for the soldier, either alone or in combinations.

The question arises, how does the efficiency indicated by this pamphlet, compare with that attained in messing the United States soldier?

The latter does not suffer by the comparison; the daily ration of a soldier in the United States army is more generous than that of the English soldier, whilst the entire cost of it is borne by the Government; it is ample when properly managed and, owing to the food supplies obtainable by purchase through the Subsistence Department, at the Post Exchange and in open market by officers in charge of company or consolidated

messes, with revenue derived from the savings of post bakeries and the distributed profits of the Post Exchanges, his diet can be increased and varied to any desirable extent.

The manual for army cooks published by authority of the Secretary of War in 1883 and General Orders, A G. O. Headquarters of the Army, Nos. 30 and 40 of 1891, and Nos. 4, 5, 13, 28, 36, and 53 of 1892, all wholly or in part having reference to economy in messing, improvement in cooking and variation and increase of diet, indicate that no subject connected with the administration of army affairs receives more constantly intelligent consideration than the messing of the United States soldier.

W. F. SPURGIN,
Capt. 21st Infantry.

West Point, N. Y., Oct. 29, 1892.

Schools and Masters of Fence.*

England, if we are to judge from the many excellent works recently published on the subject, is experiencing a revival of interest in the "noble art of fence."

Mr. Castle, Captains Hutton and Burton and other lesser lights are in no small degree responsible for this revival. These gentlemen have not only enriched the literature of the art by contributing many valuable works on fence, but, being practical swordsmen as well, have succeeded in gaining such recognition for the art as it has probably not enjoyed since the decree went forth that fashion no longer recognized the sword as an indispensable portion of gentlemen's dress. The greater number of the books published are manuals of fences; Mr. Castle's work however, is not to be classed with these. He aspires to something more lofty and what is more his aspirations are realized.

Schools and Masters of Fence is a compilation, or review, of all important works of the various schools. This literature ranging over a period of over four hundred years and printed in the Spanish, Italian, German, French and English languages, has been faithfully and most interestingly compiled. Beginning with the earliest schools, when the heaviest sword, the thickest armor and the greatest endurance went for more than science and skill, the reader is led entertainingly through the musty labyrinths of the evolution of the art of fence till he finds himself in the presence of the now prevailing French school.

The Bolognese schools, those of Spain, Germany, England, Italy and France are in turn reviewed; while the old masters, swelling with the pride of self-imposed greatness—a trait their modern colleagues seem to have inherited—have the fortes and foibles of their methods discussed in an interesting and instructive manner.

The author is not a professional swordsman and for that reason eminently better qualified to edit a work of this kind than one who is.

Professional swordsmen are usually actuated by petty jealousies from which an author of a work chiefly historical must be free.

The value of the work is greatly enhanced by a liberal interspersion of pertinent comments, explanations and comparisons; and also by many quaint illustrations, all of which are copies of the cuts which illustrate the works of the various old schools.

A complete bibliography which includes all works of note published in the various languages during the last five centuries; and a chapter on the evolution of the sword types, with many illustrations, are also included in the work.

On the whole this book may be considered the standard work on fence of modern times. It may not be amiss to say a few words regarding fencing in our own country.

* *Schools and Masters of Fence.* By Egerton Castle, M. A., F. S. A. Published by George Bell & Sons, London; Macmillan & Co., New York.

To those who have the physical welfare of our race at heart it has always been a matter of great regret that the prospects for a bright future for the "noble art of fence" are decidedly meagre. When we have made the discovery that *even* an American can overdraw his stock of nervous energy, and that recreation, nerves and muscle building exercise is a stern and absolute necessity, then, and only then, may we look forward to a revival of interest in such beneficial, life-renewing pastimes as fencing. We are, as is usually conceded, the most impatient people in the world, and it is to this that much of our apathy in matters pertaining to the art of fence and other kindred sports is due. A people, the value of whose very moments has been reduced to dollars and cents, cannot be expected to devote hours to the study of a musty old science whose only value to a civilian is pleasure and physical improvement. And yet, strange though it may seem, it is to civilians alone that we owe its existence in this country at all. In the large cities of the country Fencers' Clubs have been organized, and it is to these that the credit for the perpetuation of this science is due.

This disinterestedness on part of civilians is in no small measure due to the stand taken in this matter by the gentlemen who have adopted the profession of arms. Even the small interest displayed by civilians was at all times much greater than that displayed by those of whom it was most natural to expect it. Notwithstanding the fact that the profession of arms and the use of arms are inseparable, fencing in our army has ever existed in name only. Why army officers, who in the minds of all people are never unassociated with the sword, should exhibit such a marked disregard for the art of fence is beyond the understanding of laymen. The sword is essentially an officer's weapon and it is therefore but natural to conclude that they should display efficiency in its use. However, the promulgation of the fact that many officers are ignorant of the very rudiments of fence is not disclosing a state secret. True, the regulations do prescribe a sword manual and a series of cuts, points and parries, with which officers and men are more or less familiar; but the value of these in even a single handed engagement is very questionable. They do not convey the least conception of the possibilities of the weapon and might for that reason remain unknown and untaught. For foot officers no provision whatever is made.

Can it be that the sword is no longer considered a weapon? If that is the case why is it not abolished and some other useful weapon substituted? Military science condemns all encumbrances, and useless weapons are not only such but a nuisance besides.

It has been maintained that the sword is to be considered in the light of a badge of authority only; if that is true the feasibility of replacing it by some less cumbrous badge should suggest itself.

That a prejudice against the sword as a weapon exists, cannot be denied. But it is a prejudice born of inefficiency. No officer who is a swordsman can be convinced that the sword is not as useful a weapon to-day as it was in the recent past. Diligent practice will soon overcome any prejudice, and arguments in favor of the sword will grow apace with the progress made.

The great Von Moltke in his account of the battle of Vionville relates how eight hundred troopers of the Magdeburg Cuirassiers and Altmänkische Lancers proved most conclusively that "cold steel" is still to be considered a factor of no mean significance in deciding the fate of an army. In the face of this all arguments fall to the ground. Only recently English officers have awakened to the fact that their knowledge of the proper and efficient use of their weapons is decidedly in need of improvement, and every effort is being made to overcome this inefficiency.

Would it not be a move in the right direction if officers of our army made similar

endeavors? Military writers have caught the physical culture craze, and almost every issue of the various military journals contains a more or less profound article on the necessity for a thorough physical training of the enlisted men, in which many feasible as well as absurd suggestions are made as to how this end may be realized. In all of these, and it is a matter of no little comment, the importance of that method of training which embodies the development of more soldiery attributes than any one other method, is entirely overlooked. The importance of a thorough training in gymnastics and athletics cannot be over-estimated, but surely efficiency in the use of weapons is of far greater importance to the soldier.

But why confine this training to enlisted men? Elevating the physical standard of the men necessitates a like improvement on part of officers. The enlisted men of our army perform, besides the regular military drills, a certain amount of physical labor, which while it does not tend to develop those qualities which an ideal soldier should possess, at least serves to keep them in fair physical condition. Officers on the other hand receive few opportunities and absolutely no encouragement to develop themselves physically. The reason for this is obvious. Army officers are no longer measured by the standard of actual *soldierly* attributes, but rather by that of their familiarity with the various sciences, more or less remotely connected with the science of war—or by other scholarly attainments. Every encouragement is given them to develop superior mental qualities, often at the expense of no less important physical ones, until there is danger of being confronted by a condition such as Lord Wolseley had in mind when he spoke in Leinster Hall, Dublin, last February. He is reported as saying: "The methods of to-day are to cram the head and let the body take care of itself, making men, as it were, mere tadpoles, all head and no body. I have seen such men and all I can say is that I would rather belong to a nation where the men had fine physiques, with broad, strong chests, splendid legs and arms and fine muscles, than to a people with abnormally developed heads, wearing glasses and having poor bodies."

This is only another acknowledgment that rational education buried under the ruins of old Greece has been resurrected, that the new era is upon us and that "mens sana in corpore" is no longer a theory but a practicability. Can the army stand aloof and let the van of mental and physical equality roll by without reaping its benefits? Most assuredly not! The profession of arms, above all others, demands men physically and mentally strong; it has no use for mental giants who are physical pigmies and it should have none for physical giants with dwarfed intellects. How to bring about this equality is a question which has absorbed the attention of military writers. Would it not be advisable, until this problem is solved, to make the best use of the means at hand?

That done others will follow. Every year the government spends large sums of money, establishes shooting matches, awards prizes, in fact does everything to encourage officers and men to make themselves efficient in the use of the rifle. Why not offer the same inducements to troops whose distinctive weapon is the sword? Such encouragement would be decidedly inexpensive and while swordsmanship may not be of as great an importance in time of war, as marksmanship, it would do more toward elevating the physical standard of the troops, develop better and more confident fighters and appeal more directly to the soldierly attributes.

Whether such a venture would prove successful depends upon the encouragement it would receive from officers. As a rule enlisted men are but grown children with whom practice and example are everything, while "alle Theorie ist grau" K.

Alphabetical French-English List of Technical Military Terms for Military Students.*

Colonel F. Maurice, C. B., says of these books :—"The Dictionary of Difficulties Met With in French, in particular supplied a want which no ordinary French dictionary or other work had met.

"The present list of corresponding military terms is much more than a mere translation from one language into another.

"It required for its composition that the man who wrote it should not only be thoroughly acquainted with both languages, but that he should know well the regulations and organizations of both armies.

"In many cases it is quite as necessary not to attempt a translation, but to show that there is no equivalent in the one army for a term used in the other. Thus, for instance, a man not thoroughly acquainted with the organization of the French army, would be sorely tempted, when he found the word 'Major-General' in French, promptly to translate it as 'Major-General, in English. M. Deshumbert has to tell him that we have no equivalent in English for the position to which the name 'Major-General' is applied in French.

"Nor is this the only instance by any means in which the most useful assistance which M. Deshumbert can render is to show what the actual thing signified by a French term is, without attempting to give an English equivalent for it.

"The work ought to be valuable, not only to military students, for whom it is indispensable, but for all who have either political or commercial relations with France. In a country where every one is a soldier, it is most inconvenient for any foreigner who has to transact business of any kind not to know the correct military terms used."

Deep-sea Sounding.†

The work of Captain Barker contains an interesting and pleasantly-written account of the cruise of the *Enterprise* around the world during 1883–86 in so far as it relates to deep-sea sounding.

The sounding apparatus used was Sir William Thompson's, improved by Captain Sigsbee, consisting of a reel with accumulator and small reeling engine. This reel, which was of the ordinary service type of the day, was completely crushed while on the way to South Africa, and a new one, designed by Chief Engineer H. D. McEwan, was made at Cape Town by the mechanics on board, the only expense to the Government being the cost of material.

This improved reel was in service during the remainder of the cruise, and was so strongly constructed that, without being injured, it reeled up a 60-pound shot from a depth of 2711 fathoms.

The wire was partly of American and partly of English manufacture of No. 22 Birmingham gauge. The sinkers were 8-inch shot, weighing about 60 pounds, with a hole through the centre sufficiently large to permit the entrance and free movement of the specimen cup.

Lieutenant George A. Norris, U. S. N., took each cast from the United States to the Straits of Sunda, or across the Atlantic and Indian Oceans, and Lieutenant Adolph

**Alphabetical French-English List of Technical Military Terms for Military Students. The Dictionary of Difficulties Met With in French.* (Second Thousand). By Marius Deshumbert, Professor of French at the Staff College, Camberly, England. D. Nutt, 270 Strand or B. F. Stevens, 4 Trafalgar Square, London, England.

† *Deep-sea Sounding.* A brief account of the work done by the U. S. S. *Enterprise* in Deep-sea Sounding during 1883–1886. By Captain A. S. Barker, U. S. N. John Wiley & Sons, New York, 1890.

Marix, U. S. N., took the casts on the return voyage to the United States, Lieutenant Norris having become executive officer.

Notwithstanding the heavy seas and bad weather in these high southern latitudes, not a cast was omitted in the whole line.

The book must prove of much value to naval officers ordered on similar duty and to those desiring such information as the work amply provides.

Cycle-Infantry Drill Regulations of the District of Columbia National Guard.*

These drill regulations contain a complete system of cycle-infantry drill based on the new drill regulations for infantry in so far as these relate to a company.

The bicycle being simply a means of transportation, the company dismounts on reaching the point of destination and is then formed as a regular infantry company and manœuvred accordingly, except, that to facilitate mounting and dismounting, only a single rank is adopted.

A few pages on riot duty, care of cycles, visual signals, whistle signals and trumpet calls completes this carefully prepared little work.

The One Hundred and Fiftieth Anniversary of the Foundation of the First Corps Cadets, M. V. M.†

On October 19, 1891, one of the oldest organizations of the state services, with simple ceremonies, laid the corner stone of its new armory in Boston, Massachusetts.

The First Corps Cadets of the Massachusetts Volunteer Militia was founded on October 19, 1741, a hundred and fifty years ago, and has maintained its organization without a break till now, when under the command of its present chief Colonel Thomas F. Edmands, a new era has set in and an earnest of future stability afforded by the establishment of the fine armory building which is to house both the Cadet Corps and the Military Historical Society of Massachusetts.

Governor Russell of Massachusetts and others distinguished in that commonwealth, former members of the Corps, graced the occasion with speech and reminiscence which, put in print, together with other matters of historical interest, now forms a souvenir of an event in the life of an organization nearly unique in this country for age and continuous existence.

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* *Cycle-Infantry Drill Regulations of the District of Columbia, National Guard.* Prepared by Brig.-Gen. Albert Ordway. Judd & Detweiler, Washington, D. C., 1892.

† *The One Hundred and Fiftieth Anniversary of the Foundation of the First Corps Cadets, M. V. M.* Nathan Sawyer & Son, Boston.

LIST OF

MEMBERS AND ASSOCIATE MEMBERS

WHO HAVE JOINED THE INSTITUTION SINCE JUNE 1, 1892.

Corrected to include December 16, 1892.

Should there be any error or omission in this list, it is particularly requested that notice thereof be sent to the Secretary.

MEMBERS.

Adams, M. B., maj. eng.
Bache, Dallas, lt. col. med. dept.
Bartlett, Charles G., col. 9 inf.
Batson, M. A., 2 lt. 9 cav.
Beacom, J. H., 1 lt. 3 inf.
Bolton, E. B., capt. 23 inf.
Bradley, L. P., col. ret. (B. G.)
Brant, L. P., 1 lt. 1 inf.
Browne, E. H., 1 lt. 4 inf.
Burgess, L. R., 2 lt. 5 art.
Burt, A. S., col. 25 inf.
Carnahan, E. C., 2 lt. 12 inf.
Cavanaugh, H. G., capt. 13 inf.
Chase, A. W., 2 lt. 2 art.
Crane, C. J., capt. 24 inf.
Davis, A. M., 2 lt. 8 cav.
Davis, G. B., maj. j. a. gen. dept.
Day, F. R., 1 lt. 20 inf.
Dentler, C. E., 1 lt. 11 inf.
Dickson, T. C., 2 lt. 2 art.
Dove, W. E., 2 lt. 12 inf.
Dowdy, R. W., 1 lt. 17 inf.
Edwards, E. A., 1 lt. 25 inf.
Evans, W. P., 1 lt. 19 inf.
Gaillard, D. DuB., 1 lt. eng.
Gardner, E. F., capt. med. dept.
Gatley, Geo. G., 2 lt. 5 art.
Gerlach, W., capt. 3 inf.
Graves, W. S., 2 lt. 7 inf.
Hall, Herman, 2 lt. 4 inf.
Ham, S. V., 2 lt. 24 inf.
Hambright, H. G., 2 lt. 22 inf.
Harris, F. E., 2 lt. 1 art.
Harris, P. C., 2 lt. 13 inf.
Harvey, P. F., maj. med. dept.
Hedberg, Alfred, capt. 25 inf.
Hewitt, C. C., capt. 19 inf.
Hine, C. deL., 2 lt. 6 inf.
Hollis, M. O., 1 lt. 4 inf.
Howe, Walter, capt. 4 art.
Hoyt, R. W., capt. 11 inf.
Hughes, W. B., lt. col. q. m. dept.
Huxford, W. P., capt. ret. (maj.)
Irwin, B. J. D., col. med. dept.
Ives, F. J., capt. med. dept.
Johnson, E. M., jr., 1 lt. 17 inf.
Landers, G. F., 2 lt. 4 art.
Lee, J. M., capt. 9 inf.
Littebrant, W. T., 2 lt. 10 cav.
Lloyd, T. J., capt. 18 inf.
March, P. C., 2 lt. 3 art.
Marshall, J. M., maj. q. m. dept.
McCaskey, W. S., capt. 20 inf.
McCaw, W. D., capt. med. dept.
McGlachlin, E. F., jr., 2 lt. 5 art.
McMaster, G. H., 2 lt. 24 inf.
Mendell, G. H., col. eng.
Meriwether, F. T., 1 lt. med. dept.
Michie, D. M., 2 lt. 17 inf.
Myer, A. L., capt. 11 inf.
Normoyle, J. E., 2 lt. 23 inf.
O'Connell, J. J., capt. 1 inf.
O'Connell, J. J., 2 lt. 21 inf.
Oyster, J. S., 1 lt. 1 art.
Pardee, W. J., 1 lt. 25 inf.
Parker, L. O., capt. 1 inf.
Pipes, H. A., 2 lt. 7 inf.
Porter, Charles, capt. 8 inf.
Powell, C. F., capt. eng.
Powell, H. McL., 2 lt. 2 inf.
Powell, W. H., lt. col. 11 inf.
Prince, L. M., 2 lt. 2 inf.
Rees, T. H., 1 lt. eng.
Robert, H. M., lt. col. eng.

Scherer, L. C., 2 lt. 5 cav.
Sears, C. B., maj. eng.
Smith, W. H., 1 lt. 10 cav.
Squier, G. O., 2 lt. 3 art.
Tesson, L. S., capt. med. dept.
Threlkeld, H. L., 2 lt. 13 inf.
Tracy, Albert, maj. ret. (col.)
Turner, W. J., capt. 2 inf.
Van Deusen, G. W., 1 lt. 1 art.
Walker, G. B., capt. 6 inf.
Wallace, Wm., 2 lt. 7 inf.
Walsh, R. D., 1 lt. 4 cav.
Ward, H. C., capt. 16 inf.
Weigel, Wm., 2 lt. 11 int.
Wilkins, H. E., 2 lt. 2 inf.
Winslow, E. E., 2 lt. eng.
Wittenmeyer, E., 2 lt. 9 inf.

EX-OFFICERS, U. S. A.

Johnson, Ben., lt. 1 art.
Nesbitt, W. B., lt. 25 inf.; lt. col. 176 Ohio vols.
Paul, F. W., lt. 24 inf. (capt.)

ASSOCIATE MEMBERS.

Abernethy, H. H., col. 4 regt. n. g. N. J.
Acland, F. E. D., capt. late Royal Art.
Allstrom, J. V., maj. 3 regt. n. g. N. J.
Almy, L. B., med. director (lt. col.) n. g. Conn.
Anderson, C. J., brig. gen. Va. vols.
Barker, E. R., capt. lht. batty. A, R. I. m.
Bauder, Frank, capt. 37 sep. co. n. g. s. N. Y.
Beach, R. V., paymaster (1 lt.) 2 regt. n. g. Conn.
Beebe, J. A., asst. surg. (capt.) 1 cav. battln. n. g. Wash.
Belknap, M. B., capt. 1 regt. Ky. s. g.
Bell, W., adj. (1 lt.) 2 battln. n. g. Iowa.
Bennitt, Fred., col. 3 regt. n. g. Ill.
Berry, J. R., adj. (capt.) 9 inf. n. g. Cal.
Bigelow, C. F., 1 corps cadets, Mass. v. m.
Bigelow, H. W., capt. 14 Ohio vet. vols.
Bigelow, L. G., capt. lht. batty. B, Mass. v. m.
Bloodgood, W. D., lt. naval battln. Cal.
Blumenberg, S. P., capt. 1 troop cav. n. g. Cal.
Breintnall, R. H., lt. col. 1 regt. n. g. N. J.
Brossier, F. C., capt. 5 battln. Fla. s. t.
Brown, T. A., 2 lt. 30 sep. co. n. g. s. N. Y.
Budlong, J. C., surg. gen. (B. G.) R. I. m.
Buell, Allen, capt. 4 regt. Tex. v. g.
Bunker, H. S., col. 16 inf. n. g. Ohio.
Burns, C. M., ex-a. a. paymaster, U. S. navy.
Burr, D. S., asst. surg. (1 lt.) 20 sep. co. n. g. s. N. Y.
Burrell, H. L., med. director (lt. col.) 1 brig. Mass. v. m.
Butler, J. G., capt. 41 sep. co. n. g. s. N. Y.
Callahan, T. F., maj. 2 reg. n. g. Conn.
Cameron, J. D., 1 lt. 5 battln. Fla. s. t.
Canfield, H. H., eng. and sig. off. (lt. col.) n. g. Iowa.
Carnes, S. T., brig. gen. n. g. s. Tenn.
Casteel, D. T. E., maj. 2 regt. n. g. W. Va.
Chace, Thos. W., brig. gen. (ret.) R. I. m.
Chambers, T. S., a. a. g. (lt. col.) n. g. N. J.
Chancellor, E., med. director (lt. col.) n. g. Mo.
Chantland, W. T., 1 lt. 4 reg. n. g. Iowa.
Chase, G. H., Midvale Steel Co.
Clark, C. D., a. d. c. (lt. col.) Me. v. m.
Clark, Wm. A., 44 sep. co. n. g. s. N. Y.
Clarke, Wm. P., capt. 2. regt. n. g. Col.

Clay, A. A., capt. 58 Pa. vols.
Clayton, F. I., adj. (1 lt.) 8 regt. Mass. v. m.
Clifton, Chas., a. a. g. (lt. col.) n. g. s. N. Y.
Coleman, C. C., a. d. c. (capt.) n. g. Cal.
Collins, Chas., 1 lt. 1 regt. Me. v. m.
Cook, B. H., capt. 1 regt. n. g. Mont.
Cook, I. B., capt. 1 inf. n. g. Cal.
Cooke, T. F., gen. ins. s. a. p. (col.) n. g. Iowa.
Copp, E. J., adj. 3 N. H. vols.; ex-col. 2 regt. n. g. N. H.
Cordis, T. F., a. d. c. (capt.) Mass. v. m.
Cortelyou, L. V., asst. surg. vols.
Cox, J. W., lt. col. 1 regt. Ala. s. t.
Cranford, H. L., bvt. maj. U. S. vols.; ex-col. n. g. s. N. Y.
Crusselle, W. F.
Cunningham, T. J., capt. 2 art. n. g. Cal.
Currier, E. H., 1 lt. 1 lht. batty. n. g. N. H.
Davidson, C. L., j. a. (maj.) n. g. Iowa.
Davis, Wm. H., capt. 18 regt. n. g. Pa.
Davis, W. L., brig. gen. n. g. Iowa.
Dickinson, J. M., brig. gen., n. g. Cal.
Dodge, C. L., lt. col. 8 regt. Mass. v. m.
Dougherty, C. Bow, maj. 9 regt. n. g. Pa.
Drexel, A. J., a. d. c. (lt. col.) n. g. Pa.
Dudley, O. E., capt. 3 regt. N. C. s. g.
Edwards, J. B., surg. (maj.) 3 regt. n. g. Wis.
Estey, J. J., col. 1 regt. n. g. Ver.
Ewart, J. C., maj. 1 regt. lht. art. n. g. Ohio.
Fairbanks, D. B., col. 5 inf. n. g. Cal.
Flannery, John, capt. 1 regt. Ga. vols.
Frazar, D. W. naval res. art. s. N. Y.
Freeman, H. W., capt. and gun off. 1 regt. n. g. N. J.
Frost, Russell, col. 4 regt. n. g. Conn.
Frye, J. A., adj. (1 lt.) 1 regt. Mass. v. m.
Frye, M. G., lt. col. 1 regt. n. g. N. H.
Geary, Dennis, lt. col. 2 art. n. g. Cal.
George, T. J., maj. 3 regt. n. g. Wis.
Gerardin, B. M., adj. (capt.) 4 regt. n. g. N. J.
Gewinner, N. G., surg. (1 lt.) 2 regt. Ga. vols.
Gibson, Peter.
Giesting, J. G., a. d. c. (maj.) n. g. Cal.
Gilmore, J. C., capt. 1 inf. vet. corps, n. g. Pa.
Goodier, L. E., capt. 44 sep. co. n. g. s. N. Y.
Goss, A. P., capt. 3 regt. n. g. Wis.
Gould, Edwin, i. r. p. (capt) 71 regt. n. g. s. N. Y.
Grannis, E. H., asst. surg. (capt.) 3 regt. n. g. Wis.
Gray, L. F., capt. 4 regt. n. g. Iowa.
Griffin, A. J., 2 lt. 12 regt. n. g. s. N. Y.
Gunder, G. W., col. 4 regt. Ind. Legion.
Gurley, G. B., a. a. g. (lt. col.) Tex. v. g.
Haines, Nathan, paymaster (capt.) 6 regt. n. g. N. J.
Hall, H. A., capt. 16 regt. n. g. Pa.
Ham, C. D., a. i. g. (maj.) n. g. Iowa.
Harmon, R. F., 1 lt. Chatham art., Ga. vols.
Harrah, C. J., President Midvale Steel Co.
Harriman, J. A. naval r. a., s. N. Y.
Hartmann, E. T., 1 lt. 4 regt. n. g. Wis.
Hayes, Chas., med. director (lt. col.) R. I. m.
Hill, S. W., col. (ret.) n. g. Pa.
Hitchcock, C. H., 2 lt. 20 sep. co. n. g. s. N. Y.
Hogle, A. W., col. 1 regt. n. g. Col.
Holmes, B. P., lt. col. 3 regt. n. g. N. J.
Hopkins, O. J., maj. 1 regt. lht. art. n. g. Ohio.
Hovey, C. L., lt. col. 1 regt. Mass. v. m.
Howard, Wm. H., i. r. p. (capt.) 1 regt. n. g. N. J.

Hutt, Wm. H., M. D.
Ingraham, E. S., capt. 1 regt. n. g. Wash.
Jones, J. K., capt. Ohio vols.
Karow, E. W., 1 lt. 1 regt. Ga. vols.
Kayser, C. W., 2 lt. 23 regt. n. g. s. N. Y.
Keck, M. J., col. 9 regt. n. g. Pa.
Kehrlein, Emil, r. q. m. (1 lt.) 3 inf. n. g. Cal.
Keith, J. N., capt. 9 inf. n. g. Cal.
Kelleher, A. J., adj. (capt.) 2 art. n.g. Cal.
Kellogg, C. L. F., chf. of ord. (col.) n. g. Wash.
Kennan, J. G., capt. 1 regt. lht. art. n. g. Ohio.
King, C. W., capt. 4 regt. n. g. Iowa.
Kluppak, A. J., 1 lt. 4 regt. n. g. Wis.
Laine, J. R., med. director (col.) div. n. g. Cal.
Landon, F. G., adj. (1 lt.) 7 regt. n.g. s. N. Y.
Landon, T. D., capt. comdt. cadets (B. M. I.) n. g. N. J.
Levy, I. C., lt. col. 1 battln. Ga. vols.
Liebich, A. K. A., r. q. m. (1 lt.) 5 inf. n. g. Ohio.
Lincoln, F. T. surg. (1 lt.) Chatham art.; Ga. vols.
Locke, F. L., adj. (1 lt.) 1 battln. cav. Mass. v. m.
Lovell, R. P., 2 lt. 1 regt. Ga. vols.
Lynch, T. F., capt. 69 regt. n. g. s. N. Y.
Marsh, G. F., adj. (1 lt.) 1 regt. n. g. Mont.
Martin, J. T., maj. 1 regt. n. g. Wyo.
Mattes, C. C., r. q. m. (1 lt.) 13 regt. n. g. Pa.
McCarthy, Wm. D., surg. (maj.) 2 art. n. g. Cal.
McCrary, W. C., ord. off. (capt.) 3 regt. n. g. Mo.
McKelvey, C. S., maj. 9 inf. n. g. Cal.
McLemore, M. C., jr., a. d. c. (capt.) Tex. v. g.
Mead, Geo. W., lt. col. 2 regt. n. g. s. Minn.
Menardi, J. B., capt. 1 regt. n.g. Wyo.
Merrick, Duff, ex-capt. 4 regt. N. C. s. g.
Miner, Asher, ex-capt. 9 regt. n.g. Pa.
Mitchell, H. L., brig. gen. Me. v. m.
Moore, J. V., col. 2 regt. n. g. N. J.
Morgan, R. H., maj. 1 regt. Mass. v. m.
Morris, Newbold, 2 lt. 12 regt. n. g. s. N. Y.
Morrison, C. E., capt. 2 regt. n. g. W. Va.
Newell, Geo. M., capt. 3 regt. N. C. s. g.
Nichols, Wm. B., 1 lt. 2 corps cadets Mass. v. m.
Palmer, W. B., adj. (1 lt.) 1 regt. n.g.s Minn.
Parker, A. J., ex-brig. gen. n. g. s. N. Y.
Parker, J. A., a. a. g. (lt. col.) 1 brig. n. g. N. J.
Petre, Axel, Gen. Supt. Midvale Steel Co.
Pew, Wm. A., jr., maj. 8 regt. Mass. v. m.
Pfaff, Chas., capt. 1 regt. Mass. v. m.
Pike, E. W., col. 2 regt. n. g. Wash.
Potter, Thos., jr., a. d. c. (capt.) n. g. Pa.
Pratt, Dallas B., banker.
Price, M. McD., 1 lt. 1 regt. n. g. W. Va.
Ransom, R. S., lt. 50 N. Y. vol. engs.
Reeder, R. P., 2 lt. Mich. s. t.
Reilly, John, capt. 3 battln. Ga. vols.
Rice, C. T., r. c. s. (1 lt.) 9 inf. n. g. Cal.
Ricker, N. H., lt. col. 3 regt. Tex. v.g.
Rodman, W. B., jr., maj. 1 regt. N. C. s. g.
Rogers, A. C.
Rogers, J. I., j. a. g. (col.) n. g. Pa.
Rosenberg, Felix, Cleveland Grays.
Rudy, J. W., capt. 4 regt. n. g. Iowa.
Rule, James, lt. col. 4 regt. n. g. Iowa.
Scheide, Millard, 1 lt. 16 regt. n. g. Pa.
Sexton, Warren, capt. 8 inf. n. g. Cal.

Sheehan, T. W., brig. gen. n. g. Cal.
Sigsbee, W. A., capt. 4 battln. Fla. s.t.
Skirm, Wm. H., col. 7 regt. n. g. N. J.
Smidt, F. B.
Smith, M. H., lt. 3 N. Y. vol. cav.
Smith, R. M., col. 4 regt. n. g. Ill.
Spencer, Wm. E., surg. (maj.) 23 regt. n. g. s. N. Y.
Spilman, B. D., brig. gen. n. g. W. Va.
Stelle, M. B., 1 lt. 7 regt. n. g. s. N.Y.
Stevens, C. W., q. m. gen. (B. G.) n. g. N. H.
Stevens, F. L., 1 lt. 32 sep. co. n. g. s. N. Y.
Stout, J. K., chf. sig. off. (col.) n. g. Wash.
Strange, Wm., div. q. m. (lt. col.) n. g. N. J.
Streator, J. B. R., lt. col. 10 regt. n. g. Pa.
Styron, J. A., lt. col. 4 regt. Tex. v. g.
Sullivan, W. P., jr., col. 1 inf. n. g. Cal.
Sumner, F. W., paymaster gen. (col.) n. g. Cal.
Thompson, D. A., adj. (1 lt.) 1 battln. art. Ind. legion.
Tolman, E. B., capt. 1 regt. n. g. Ill.
Treadwell, G. H., bvt. maj. U. S. vols.
Trenoweth, W. C., capt. 3 regt. n. g. N. H.
Trester, H. W., capt. 2 regt. n. g. Wis.
Utter, F. A., M. D., bvt. capt. U. S. vols.
Van Keuren, L. N., ex-a.a.g. (lt. col.) n. g. Conn.
Wanser, P. F., brig. gen. n. g. N. J.
Warring, F. B., 1 lt. 15 sep. co. n. g. s. N. Y.
Webb, Wm. S., i. r. p. (col.) n. g. Ver.
Webster, G. B., capt. 2 regt. n. g. Mo.
Welch, S. M., jr., col. 65 regt. n. g. s. N. Y.
Wells, J. E., capt. 2 regt. Ga. vols.
West, C. H., capt. 1 regt. n. g. Miss.
Wheaton, C. A., surg. gen. (B. G.) n. g. s. Minn.
Whitlock, B. M., ins. gen. i.r.p. (B. G.) n. g. s. N. Y.
Whitney, R. E., 2 lt. 23 regt. n. g. s. N. Y.
Whitten, B. D., capt. 1 regt. n. g. Mont.
Wightman, L. H., 1 lt. 1 corps cadets, Mass. v. m.
Wilbur, R. H., a. d. c. (lt. col.) n. g. Pa.
Williams, Chas. R., 2 regt. n. g. Col.
Williams, F. D., adj. (lieut.) naval brigade, Mass. v. m.
Williamson, Wm. W., capt. 3 battln. Ga. vols.
Wilson, Joel, capt. 1 Me. vol. cav.
Wilson, Wm., capt, 34 sep. co. n. g. s. N. Y.
Wright, G. M., 2 lt. 1 regt. lht. art. n. g. Ohio.

ERRORS IN THE JULY LIST.

Names or titles should read as follows.

MEMBERS.

Clayton, Powell, jr., 2 lt. 5 cav.
Fearing, G. R., ex.-a. a. d. c. (maj.) Since col. Newport art., R. I. m.
Oliver, R. S., ex-lt. 8 cav. Since B. G. n. g. s. N. Y.
Russell, F. W., ex-lt. 6 cav. Since a. i. g. (maj.) n. g. N. H.

ASSOCIATE MEMBERS.

Caffee, Wm. K. col., 2 regt. n. g. Mo.
Cole, G. M., a. a. g. (lt. col.) n. g. Conn.
Dana, Paul, ord. off. (maj.) 1 brig. n. g. s. N. Y.
Davidson, R. M., maj. 17 regt. n. g. Ohio.
Davies, H. E., bvt. M. G.; U. S. vols.
McClellan, O. E., a. d. c. (lt. col.) n g. Pa.
Metcalf, Willis, capt. lht. batty. A, n. g. Kan.
Pocock, E. J., adj. gen. (M. G.) Ohio.
Rice, E. L., jr., capt. 1 cav. n. g. Del.

LIQUID BREAD.

An Absolutely Pure Malt Extract.

DAVID NICHOLSON, Proprietor.

ST. LOUIS.

Liquid Bread.

When we first conceived the idea to manufacture this nutritive tonic we were uncertain as to success, but knowing there was abundant room and place for it, if a really fine article could be produced, the experiment was made. It was our most earnest desire to produce, through the use of the choicest materials and most improved modern scientific appliances, aided by the highest educated skill and intelligence, a quality of Malt Extract unequalled by any other that hatl yet been put before the public. It was not merely an article that would sell that we sought to create. IT WAS ONE OF THE STRICTEST INTRINSIC MERIT that we aimed to produce, and to accomplish this we spared neither time, labor nor expense. Three years passed while we were yet continuously applying ourselves diligently to the task of bringing from the sum of our labors the result sought for; finally we succeeded, and for nearly nine years the verdict of the medical schools and the public throughout this land has been attested and sealed by their appreciation of its superior merit as the continuously growing demand through each successive year since its introduction to the people has shown. Its analysis, which we have often published, proves it to be the most delicate and at the same time the most nutritious of all modern Malt Liquids. It is pleasant to the taste, gracious to the stomach and generous in its production of new blood and flesh, a reinvigorator of mind and body, besides being to old people, invalids, delicate children and nursing mothers a priceless panacea. The leading physicians prescribe it. It is sold everywhere by grocers and druggists.

ANALYSIS OF LIQUID BREAD.

ITS CHEMICAL CONSTITUENTS ARE AS FOLLOWS:

	PRESENT.		PRESENT.
MALT EXTRACTIVE,	18.07	CARBONIC ACID,	.05
ALCOHOL,	2.83	LIQUID,	79.05

THE MALT EXTRACTIVE IS FOUND TO BE COMPOSED OF

PRODUCE OF TORREFACTION,	14.0	ALBUMINOUS SUBSTANCES,	11.5
DEXTRINE,	2.4	FATTY SUBSTANCES,	2.6
STARCH,	0.6	ASH, ETC.,	2.7
SUGAR,	48.5		100.0
CELLULOSE,	11.5		

There are no Foreign Substances or Deleterious Admixtures of any kind.

This preparation is what it claims to be—"a wholesome, refreshing, invigorating tonic; a remedial agent, assisting the constitution to overcome the various weakening and wasting maladies, and building up a healthy body again. Its great advantages are its very low alcoholic constituent with very high sugar, albuminoid and cellulose constituents, combining to furnish a hydrocarbon liquid, palatable to the taste and of easy assimilation.

U.M.C.

TRADE MARK.

MILITARY CARTRIDGES

—FOR—

United States and Foreign Government

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PRIMERS, ETC., ETC.

GOVERNMENT CONTRACTORS

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CABLE ADDRESS, HARTLEY, NEW YORK.

SERVICEABLE SPECIALTIES.

PICHI (*Fabiana Imbricata*), is an emollient, sedative and diuretic in diseases of the Urinary Organs.

It has been found efficient in gonorrhœa, cystitis, dysuria, urinary calculus, and all irritable and inflammatory conditions of the bladder and urinary tract.

The pharmaceutical preparations of Pichi are Fluid Extract and Solid Extract Pichi and Soluble Elastic Capsules Pichi, 5 grs.

CACTUS GRANDIFLORUS is a heart tonic *par excellence*. In these days when so many persons die of heart failure, the selection of a heart tonic is important.

According to J. Fletcher Horne, M.D., in *London Lancet*, it is especially valuable in nervous and functional disorders of the heart, where digitalis and strophanthus are unsatisfactory, such as palpitation, irregularity, fluttering, intermission, slow or rapid action arising from debility, worry, dyspepsia, or the excessive use of tea and tobacco, comprehensively classed as cardiac erethism.

CREASOTE is of all the methods of treating consumption the most satisfactory.

We supply Creasote in Soluble Elastic Capsules (Cod Liver Oil, 10 minims, Creasote, 1 minim), and Enteric Pills of Creasote coated with a material that resists the action of the gastric juice but dissolves in the duodenum.

☞ *Samples will be sent, on receipt of request, to physicians who indicate their willingness to pay express charges.*

PARKE, DAVIS & CO.

DETROIT, NEW YORK AND KANSAS CITY.

Prize Essay—1893.

I.—The following Resolution of Council is published for the information of all concerned:

Resolved, That a Prize of a Gold Medal of suitable value, together with a Certificate of Life Membership, be offered annually by THE MILITARY SERVICE INSTITUTION OF THE UNITED STATES for the best essay on a military topic of current interest; the subject to be selected by the Executive Council and the Prize awarded under the following conditions:

1. Competition to be open to all persons eligible to membership.*

2. Each competitor shall send three copies of his Essay in a sealed envelope to the Secretary *on or before September* 1, 1893. The Essay must be strictly anonymous, but the author shall adopt some *nom de plume* and sign the same to the Essay, followed by a figure corresponding with the number of pages of MS.; a sealed envelope bearing the *nom de plume* on the outside, and enclosing full name and address, should accompany the Essay. This envelope to be opened in the presence of the Council after the decision of the Board of Award has been received.

3. The prize shall be awarded upon the recommendation of a Board consisting of three suitable persons chosen by the Executive Council, who will be requested to designate *the Essay deemed worthy of the prize;* and also in their order of merit those deserving of honorable mention.

4. The successful Essay shall be published in the Journal of the Institution and the Essays deemed worthy of honorable mention, shall be read before the Institution, or published, at the discretion of the Council.

5. Essays must not exceed twenty thousand words, or fifty pages of the size and style of the JOURNAL (exclusive of tables).

II.—The Subject selected by the Council at a meeting held Nov. 11, 1892, for the Prize Essay of 1893, is

"THE NICARAGUA CANAL IN ITS MILITARY ASPECTS."

III.—The names of the members of the Board of Awards will be announced in the JOURNAL for March, 1893.

WM. L. HASKIN,
Secretary.

GOVERNOR'S ISLAND,
January 1, 1893.

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* "All officers of the Army and Professors at the Military Academy shall be entitled to membership, *without ballot*, upon payment of the entrance fee. Ex-officers of the Regular Army of good standing and honorable record shall be eligible to full membership of the Institution *by ballot* of the Executive Council.

"Officers of the United States Navy or Marine Corps shall be entitled to membership of the Institution *without ballot*, upon payment of the entrance fee, but shall not be entitled to vote, nor be eligible to office.

"All persons not mentioned in the preceding sections, of honorable record and good standing, shall be eligible to Associate Membership *by a confirmative vote* of two-thirds of the members of the Executive Council present at any meeting. Associate Members shall be entitled to all the benefits of the Institution, including a share in its public discussions, but no Associate Member shall be entitled to vote or be eligible to office."

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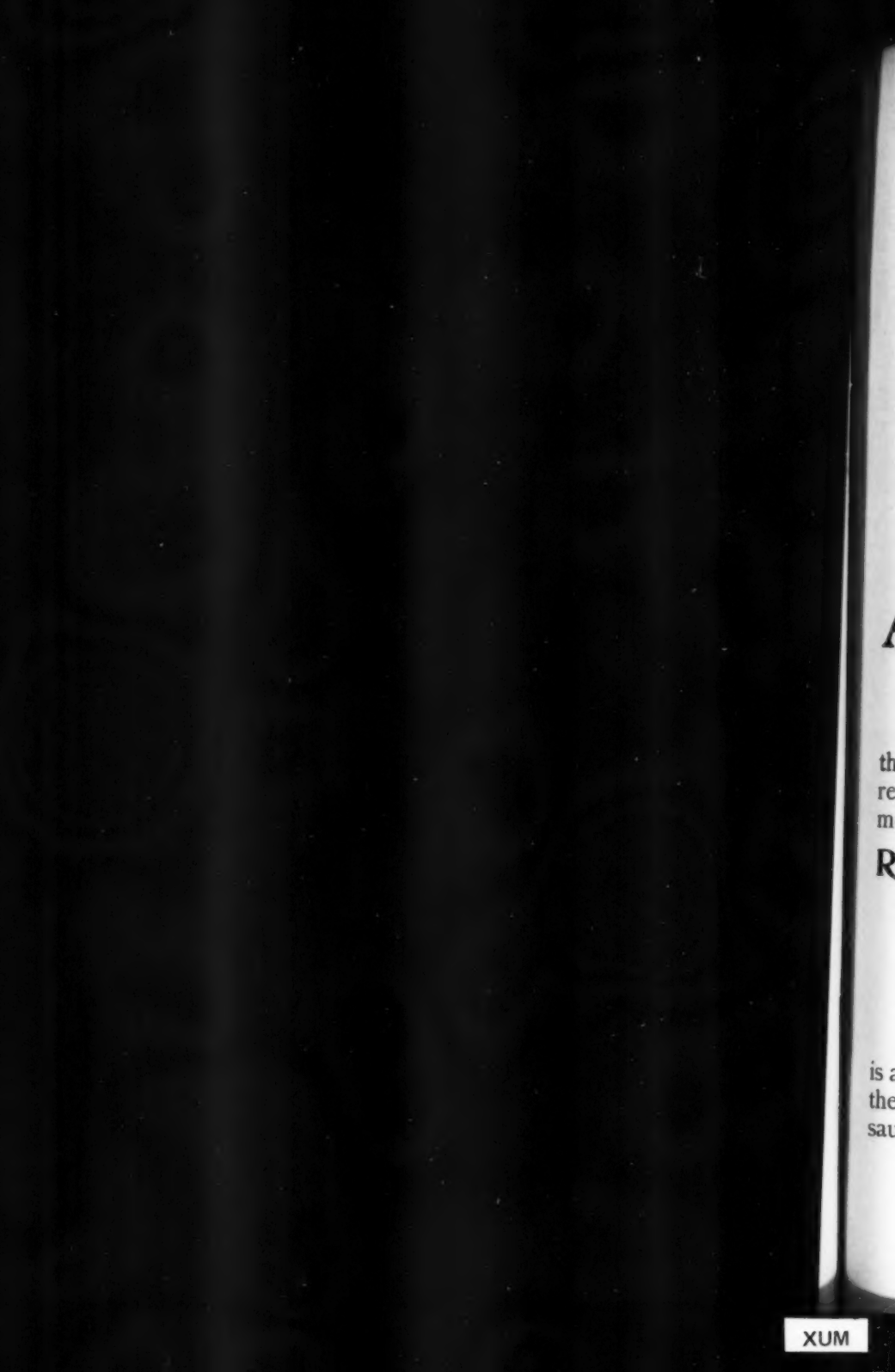

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THE SUBSISTENCE DEPARTMENT.

By BVT. BRIG.-GEN. JOHN W. BARRIGER,

Assistant Commissary General U. S. Army.

THE first legislation relative to subsistence of the Army is found in the resolution of the Continental Congress passed June 16, 1775, creating general and general-staff officers for the Army of the United Colonies, which provided that there should be, among the latter class of officers, "one commissary-general of stores and provisions."

On the 17th of July, 1775, Congress passed a resolution, upon the recommendation of Maj.-Gen. Philip Schuyler, commanding the New York Department, authorizing a deputy commissary-general of stores and provisions for that department, and immediately thereafter elected Walter Livingston to fill the office.

On the 19th of July, 1775, a dispatch from Gen. Washington, dated Cambridge, July 10, 1775, reporting his assumption of command of the Army, and recommending, among other things, that Joseph Trumbull, of Connecticut, be appointed commissary-general of stores and provisions, was laid before Congress. After the same had been read and considered, the following resolution was passed:

"*Resolved*, That Joseph Trumbull be commissary-general of stores and provisions for the Army of the United Colonies."

On the 29th of April, 1776, Congress, having had under consideration the report of the committee on supplying the troops in Canada, passed a resolution authorizing the appointment of a deputy commissary-general of stores and provisions for the Army of the United Colonies in Canada, and then elected Mr. J. Price to fill the office.

In 1777, so much dissatisfaction prevailed with respect to the administration of the officers of the "Commissary's Department," that the matter was made the subject of an investigation by Congress, resulting in the passage of a resolution on the 10th of June, 1777, instituting a new system, upon a different principle, under an elaborate code of regulations. The following extracts from the code, which constituted the resolution, show the principal features of the new system:

"*Resolved*—

"I. That for supplying the army of the United States with provisions, one commissary-general and four deputy commissaries-general of purchases, and one commissary-general and three deputy commissaries general of issues, be appointed by Congress.

* * *

"III. That the deputy commissaries-general have authority to appoint as many assistant commissaries to act under them as may from time to time be necessary, and the same to displace at pleasure, making returns

thereof to the commissaries-general respectively, who shall have full power to limit their numbers, to displace such as they shall think disqualified for their trust, and direct their respective deputy commissaries-general to appoint others in their stead; that special care be taken by the officers empowered as aforesaid, to appoint none but persons of probity, capacity, vigilance, and attachment to the United States, and the cause they are engaged in; and to make returns to the board of war, the commander-in-chief, and the commanders of the respective departments, of the assistant commissaries by them respectively appointed, their several places of abode, the time of their appointment and dismission, and the post, place, magazine, or district to which they are severally assigned; and that the deputy commissaries-general of purchases, and issues, in the same district make similar returns to each other.

"IV. That the commissary-general of purchases shall superintend the deputy commissaries-general of purchases, and assign to each a separate district, who shall constantly reside therein, and not make any purchases beyond the limits thereof; and every purchaser employed therein shall also have a certain district assigned him by the respective deputy commissary-general, in which he shall reside, and beyond the limits of which he shall not be permitted to make any purchases, unless by special order of his superior, directing the quantity and quality of provisions so to be purchased beyond his limits, and informing such purchaser of the prices given by the stationed purchaser in the district to which he may be sent.

* * *

"VII. That it shall be the duty of the commissary-general of purchases, with the assistance of the deputy commissaries-general, and assistant commissaries of purchases, to purchase all provisions and other necessaries allowed, or which may be hereafter allowed by Congress to the troops of the United States, and deliver the same to the commissary-general of issues, or his deputies, or assistants, in such quantities, and at such places or magazines, as the commander-in-chief, or the commander of the respective departments, shall direct.

* * *

"XX. That the commissary-general of issue shall superintend the respective deputy commissaries-general of issues, and assign to each a separate district; and have full power to suspend them and appoint others for a time, as already appointed for the commissary-general of purchases."

* * *

By a resolution passed on the 11th of June, 1777, the next day after the adoption of the new commissariat system, Congress directed that the commissary-general of purchases should "keep his office in the place where Congress shall sit, and that he or his clerk constantly attend therein."

On the 18th of June, 1777, Congress proceeded to the election of officers for the new Commissary's Department, and the ballots having been taken and examined, the following persons were declared elected, viz., Joseph Trumbull, commissary-general of purchases, William Aylett, William Buchanan, Jacob Cuyler and Jeremiah Wadsworth, deputy commissaries-general of purchases; Charles Stewart, commissary-general of issues, and

William Green Mumford, Matthew Irwin and Elisha Avery, deputy commissaries-general of issues.

An additional deputy commissary-general of purchases and one additional deputy commissary-general of issues, for supplying the troops in the State of Georgia, were authorized by a resolution of Congress passed August 1, 1777. On the 6th of the same month, James Roe and John Bohun Garardeau, were elected to fill the offices, respectively.

The resignation of Joseph Trumbull, commissary-general of purchases, was received by Congress on the 2d of August, 1777, and on the 5th William Buchanan, a deputy commissary-general of purchases, was elected to fill the vacancy.

On the 6th of August, Congress proceeded to the election of officers to fill vacancies in the Commissary's Department. Ephraim Blaine was elected a deputy commissary-general of purchases, *vice* Buchanan, promoted; Archibald Stewart, a deputy commissary-general of issues, *vice* Hoops, resigned; and James Blicker, a deputy commissary-general of issues, *vice* Avery, resigned. An additional deputy commissary-general of purchases was, on the same day, authorized for the Eastern Department, and Samuel Gray elected to fill the office.

On the 11th of August, 1777, Peter Colt was elected a deputy commissary-general of purchases, *vice* Wadsworth, resigned.

On the 9th of April, 1778, Jeremiah Wadsworth, who had recently resigned as a deputy commissary-general of purchases, was elected commissary-general of purchases, *vice* Buchanan, and administered the office until January 1, 1780, when he resigned, and was succeeded by Ephraim Blaine, then a deputy commissary-general of purchases.

The laws relating to the purchasing branch of the Commissary's Department were further perfected by the following resolution of Congress, passed November 30, 1780:

"*Resolved*, That there be a commissary-general of purchases, whose duty shall be to purchase provisions under the direction of Congress, the commander-in-chief, or board of war; to call upon the principal State agents or commissioners for such supplies as their respective legislatures shall make provision for, keep up a regular correspondence with them, to the end that their prospects of furnishing such supplies may be fully known; of which correspondence he shall keep a fair and correct register, as well as every other official transaction; to direct the quantities and species of provisions to be stored in the magazines of the several States, under the orders of the commander-in-chief, and cause the same to be furnished to the army, as occasion may require; for which purpose he is empowered to call on the quartermaster-general and the deputy quartermasters for the means of transportation; to make monthly returns to the commander-in-chief and the board of war of all persons employed by him, specifying for what time and on what terms; and of all provisions received in each month, from whom, from what State, and the quantities delivered to the issuing commissaries, their names, and at what posts; also of all provisions remaining on hand, at what magazines, and in whose care; the returns to be made up to the last day of each month, and forwarded as soon as may be; to cause al

of his accounts with the United States to be closed annually, on the 1st of January, and laid before the board of treasury for settlement by the 1st day of March ensuing."

On the 28th of June, 1781, Congress passed the following order:

"*Ordered*, That a committee of three be appointed to devise the mode of transferring to the superintendent of finance the business of the several boards and departments to which the institution of his office extends, in order that the said boards and departments may be discontinued as soon as the situation of affairs will admit."

On the 10th of July Congress, in pursuance of the object contemplated by the foregoing order, upon the recommendation of the Board of War, passed the following resolution, transferring the duty of procuring all supplies for the Army to the superintendent of finance, then the head of the Treasury Department:

"*Resolved*, That the superintendent of finance be, and he is hereby authorized, either by himself or such other person or persons as he shall, from time to time, appoint for that purpose, to procure, on contract, all necessary supplies for the army or armies of the United States, and also for the navy artificers, or prisoners of war, and also the transportation thereof; and all contracts or agreements heretofore made, or which shall be hereafter made, by him, or persons under his authority, for the purpose aforesaid, are hereby declared to be binding on the United States."

Under this resolution the commissariat system of subsisting the army was discontinued and the method of contracts for rations adopted in its stead.

The office of superintendent of finance was abolished by an ordinance of Congress passed May 28, 1784. This ordinance created a board of three commissioners, styled the "Board of Treasury," to be appointed by Congress, to superintend the Treasury and manage the finances of the United States. All the duties of the superintendent of finance were transferred to this board, including, of course, the furnishing of subsistence, and all other classes of army supplies, and providing transportation for the same. This duty was, however, rendered almost nominal by the legislation of June 2 and 3, which fixed the strength of the forces to be maintained in the service of the United States at about 800 men, 700 of whom were militia called into service for twelve months, "for the protection of the northwestern frontiers, and for guarding the public stores."

There was no further legislation touching subsistence of the army until after the reorganization of the Government under the Constitution.

Under the provisions of the first section of the act of the 1st Congress, entitled "An Act to establish an Executive Department, to be denominated the Department of War," approved August 7, 1789, the duty of procuring "warlike stores" was entrusted to the Secretary of War, but by Section 5 of the act of May 8, 1792, making alterations in the Treasury and War Departments, the duty of making "all purchases and contracts for supplying the army with provisions, clothing, supplies in the quartermaster's department, military stores, Indian goods, and all other supplies or articles for the use of the Department of War," was again devolved upon the Treasury Department.

An act was passed on the 23d of February, 1795, creating "in the Department of the Treasury an officer to be denominated 'purveyor of public supplies,'" whose duties were "under the direction and supervision of the Secretary of the Treasury, to conduct the procuring and providing of all arms, military and naval stores, provisions, Indian goods, and generally, all articles of supply requisite for the service of the United States."

In 1798, there were serious apprehensions of a war with France, and Congress, apparently conscious of the inherent weakness of a military system so organized that the War Department did not have control of the procurement of its own supplies, restored to it that very essential function, by making the purveyor of public supplies, although an officer of the Treasury Department, subject to the orders of the Secretary of War in all matters relating to army supplies, except the auditing and settlement of accounts therefor, which were rendered to the Treasury Department. This restoration was effected by Sections 3, 4 and 5 of the act approved July 16, 1798, entitled "An Act to alter and amend the several acts for the establishment and regulation of the Treasury, War and Navy Departments."

By Section 3 of the act approved March 16, 1802, entitled "An Act fixing the Military Peace Establishment of the United States," it was provided that there should be "three military agents and such number of assistant military agents as the President of the United States shall deem expedient, not exceeding one to each military post; which assistants shall be taken from the line." It was made the duty of the military agents "to purchase, receive, and forward to their proper destination, all military stores and other articles for the troops in their respective departments, and all goods and annuities for the Indians, which they may be directed to purchase, or which shall be ordered into their care by the Department of War."

The military agency system proved to be unsatisfactory, but no action was taken by Congress towards its abolishment until 1812. Our relations with Great Britain had then become so much strained that Congress deemed it prudent to commence making preparations for war. An act was passed on the 2d of January of that year authorizing the President to raise a force of Rangers for the protection of the frontiers from invasion by the Indians; on the 11th of the same month, an act was passed authorizing an increase in the army of ten regiments of infantry, two regiments of artillery, and one regiment of light dragoons and on the 6th of February another act was passed authorizing the President to accept the services of organized companies of volunteers, either of artillery, cavalry, or infantry, not exceeding, in the aggregate, 30,000 men. On the 28th of March, an act was passed abolishing the military agency system of supplying the Army, and substituting therefor a Purchasing Department and a Quartermaster's Department.

The strained relations with Great Britain, heretofore alluded to, culminated in a formal declaration of war by an act of Congress passed June 18, 1812.

The new staff system did not, however, bring with it any change in the mode of subsisting the Army, which was by contracts for rations delivered at the places of issue. This mode of subsisting the Army, although it had

been in operation since 1781, was now, for the first time, to be subjected to the test of war. It soon proved to be a great failure, as official reports from Gen. Dearborn and other commanders of troops on the Canadian frontier, show that as early as November and December, 1812, they were in dire extremities on account of deficiency of rations, arising from failure of contractors to make deliveries according to their contracts.

On the 3d of March, 1813, an act was passed with the significant title of "An Act better to provide for the supplies of the Army of the United States, and for the accountability of persons intrusted with the same." The second section of this act provided that there should be a "superintendent-general of military supplies," whose functions were to keep proper accounts of all the military stores and supplies purchased for, and distributed to, the Army of the United States; to prescribe the forms of all returns and accounts of such stores and supplies, and to credit and settle the accounts of disbursing officers; also, to transmit all such orders, and, generally, to perform all such other duties respecting the general superintendence, purchase, transportation, and safe-keeping of military stores and supplies, and the accountability therefor as might be prescribed by the Secretary of War.

Section 8 of this act empowered the President to appoint one or more special commissioners for the purpose of supplying by purchase or contract, and of issuing, or to authorize any officer or officers of the Quartermaster's Department to supply and issue the whole or any part of the subsistence of the Army, in all cases when, from want of contractors, or from any default on their part, or from any other contingency, such measure might be proper and necessary in order to insure the subsistence of the Army.

Notwithstanding this remedial legislation, the trouble about purchasing rations for the troops from the contractors continued. On the 12th of November, 1814, the Committee on Military Affairs of the House of Representatives took up the matter, and, after having had the same under consideration, instructed its chairman to address a communication to the Secretary of War, requesting information on the following points, viz.:

"1. What is the present mode of subsisting the Army?

"2. If by contracts, what are the defects, if any, and the remedy?

"3. Whether any other mode can be adopted, combining, in a greater degree, certainty and promptitude with economy and responsibility?

"4. Whether the alternative afforded by law of substituting commissaries for contractors has been adopted; and, if yes, what has been the general result?"

Under date of December 23, 1814, the Acting Secretary of War, Hon. James Monroe, replied, in substance, that, not wishing to rely altogether on his own judgment in answering the inquiries of the committee as to the best mode of subsisting the Army, he had consulted the officers of the greatest experience who were within his reach, on the presumption that he should best promote the views of the committee by collecting all the information he could on the subject. He submitted, as inclosures to his reply, letters from Gen. Scott, Gen. Gaines and Col. Fenwick, all of whom expressed a decided preference for the system of supply by commissaries to that by contractors. He also stated that he believed that offic rs generally

concurred with them in that preference, and that the proposition to establish the commissariat system of subsisting the Army had his unqualified approval.

On the next day, January 24, 1814, after the Committee on Military Affairs had presented the report of the Acting Secretary of War to the House of Representatives, Hon. George M. Troup, of Georgia, the chairman of the committee, introduced a bill entitled "A Bill making provision for subsisting the Army of the United States, by authorizing the appointment of Commissaries of Subsistence," which was read the first and the second time, and referred to the Committee of the Whole. On the 7th of February the bill, after having been amended in some respects, was passed and sent to the Senate.

The bill was taken up in the Senate on the 10th of February, read the first and the second time, and referred to the Committee on Military Affairs. On the 11th of February it was reported back to the Senate, with some proposed amendments. On the 13th of February the Senate, sitting as in committee of the whole, agreed to the proposed amendments, when the committee rose, and the bill, as amended, was reported back to the Senate and ordered to be engrossed and read the third time, as amended. On the 14th of February the bill was reported as correctly engrossed. On the 15th of February, on motion of Mr. Tait, of Georgia, the further consideration of the bill was postponed until the following Monday. This postponement was, presumably, due to the fact that on that day President Madison sent a message to the Senate transmitting a copy of the treaty of peace between Great Britain and the United States, which had been signed at Ghent on the 24th of December previous.

On the 21st of February, the further consideration of the bill was again postponed until the following Monday.

The return of peace had materially changed the aspect of our military affairs. The pressure of the necessity for immediate legislation changing the mode of subsisting the Army had been relaxed, and this, with the proximity of the end of the session of Congress, seems to have prevented the bill, although in such an advanced stage towards becoming a law, from being taken up according to postponement, or again before the final adjournment on the 4th of March, with which the Congress expired, and with it, of course, this, and all other pending bills.

The subject was not again taken up by Congress until a repetition of our former adverse experiences with the contract made of subsisting the Army brought it into conspicuous prominence.

In 1817, the Seminole Indians, of Florida, then a province of Spain, began to make hostile demonstrations on the southern frontier of Georgia, then embraced within the limits of the Division of the South, commanded by Maj.-Gen. Andrew Jackson. The available regular troops were ordered into the field, and, in addition, a brigade of Georgia militia, commanded by Brig.-Gen. Glasscock, was called into the service of the United States.

The contractor for furnishing rations in the district covering the theatre of military operations, was duly notified to make deposits of provisions at the places where they would be needed in order to carry out the plan of

campaign, but he failed to do so with punctuality, and, in consequence, military movements were delayed, and, in December, 1817, and January, 1818, the situation had become well-nigh desperate.

On the 21st of January, 1818, the matter was brought to the attention of the Senate by Mr. Williams, of Tennessee, of the Committee on Military Affairs, who introduced a resolution, which was adopted, requesting the President of the United States "to inform the Senate in what manner the troops in the service of the United States, now operating against the Seminole tribe of Indians, have been subsisted, whether by contract or otherwise, and whether they have been furnished regularly with rations."

On the 30th of January, the President, Hon. James Monroe, replied by message, inclosing a report on the subject of the inquiry, from the Secretary of War, Hon. John C. Calhoun, stating that the method of subsisting the troops was by contract; that the Department of War, anticipating an increased demand for rations in that quarter, had made early and liberal advances of money to the contractor to enable him to give prompt obedience to the requisitions of the commanding general; that requisitions for deposits, in advance, under the terms of the contract, at the several posts on the frontier of Georgia and in the adjacent territory, had been made; that, according to the last official reports, these requisitions had not been complied with, and that the commandant had detailed officers of the Army to supply the deficiency by purchase. He called attention to inclosed reports from Gen. Gaines, Gen. Glasscock, Col. Brearly, and Lieut.-Col. Arbuckle, showing the extent of the actual failure and the evils apprehended from an anticipated one.

On the 18th of February, Hon. James Barbour, of Virginia, introduced the following resolution in the Senate:

"*Resolved*, That the Committee on Military Affairs be instructed to inquire into the expediency of changing the mode of supplying the troops of the United States by contract, and substituting one cheaper and more efficient, by subjecting the parties who undertake that duty, to military law, in case of delinquency."

On the 20th of February, the Senate resumed consideration of this resolution, and adopted it.

On the 24th of February, the Senate passed a resolution requesting the President of the United States to furnish the Senate with a copy of the contract under which rations were to be furnished at the several posts on the frontier of Georgia and in the adjoining territory; a statement of the amounts and dates of requisitions and by whom made; the particular instances in which the contractor had failed to furnish rations agreeably to his contract; the amount of money advanced by the Government for supplies, in consequence of such failures; and the amount of money advanced by the Government to the contractor, at or before the time of said failures.

On the 11th of March the President replied to the resolution, by message, transmitting a report from the Secretary of War containing the information called for.

On the 20th of March, Mr. Williams, of Tennessee, from the Committee on Military Affairs, to whom a bill entitled "A Bill to reduce the

Staff of the Army," had previously been referred, reported the same back to the Senate, with an amendment, which was read and, on the 25th of March, adopted. After further amendments of the amendment, in both the Senate and House of Representatives, the bill finally became a law on the 14th of April, under the amended title of "An Act regulating the Staff of the Army."

The amendments above referred to, constituted Sections 6, 7, 8, 9 and 10, of the act as passed, and laid the foundation of the present Subsistence Department. These sections were as follows:

"SECTION 6. That as soon as the state of existing contracts for the subsistence of the army shall, in the opinion of the President of the United States, permit it, there shall be appointed by the President, by and with the advice and consent of the Senate, one commissary-general, with the rank, pay, and emoluments of colonel of ordnance, who shall, before entering on the duties of his office, give bond and security, in such sum as the President may direct; and as many assistants, to be taken from the subalterns of the line, as the service may require, who shall receive $20 per month in addition to their pay in the line, and who shall, before entering on the duties of their office, give bond and security, in such sums as the President may direct.

"SECTION 7. That supplies for the army, unless, in particular and urgent cases, the secretary of war should otherwise direct, shall be purchased by contract, to be made by the commissary-general on public notice, to be delivered, on inspection, in the bulk, and at such places as shall be stipulated; which contract shall be made under such regulations as the secretary of war may direct.

"SECTION 8. That the President may make such alterations in the component parts of the ration as a due regard to the health and comfort of the army and economy may require.

"SECTION 9. That the commissary-general and his assistants shall not be concerned, directly or indirectly, in the purchase or sale, in trade or commerce, of any article entering into the composition of the ration allowed to the troops in the service of the United States, except on account of the United States, nor shall such officer take and apply to his own use any gain or emolument for negotiating or transacting any business connected with the duties of his office, other than what is or may be allowed by law; and the commissary-general and his assistants shall be subject to martial law.

"SECTION 10. That all letters to and from the commissary-general, which may relate to his office duties, shall be free from postage: *Provided*, That the sixth, seventh, eighth, ninth, and tenth sections of this act shall continue and be in force for the term of five years from the passing of the same, and thence until the end of the next session of Congress, and no longer."

Col. George Gibson, of Pennsylvania, then a quartermaster-general of division, which grade was abolished by Section 3 of the above-mentioned act, was appointed commissary-general of subsistence, on the 18th of April, 1818, and his appointment was announced to the Army in a general order

issued on the 30th of April, 1818. The new system of subsisting the Army did not, however, go into operation until the 1st of June, 1819.

On the 28th of December, 1820, pursuant to a resolution of the House of Representatives adopted on the 20th of November previous, Mr. Smyth, of Virginia, from the Committee on Military Affairs, reported an elaborate bill to reduce the Army to six thousand men. This bill, after having been debated in both branches of Congress, and sundry amendments made thereto, finally became a law on the 2d of March, 1821, under the title of 'An Act to reduce and fix the Military Peace Establishment of the United, States." By the following section of this act, the organization of the Subsistence Department provided for by the act of April 14, 1818, was retained with only slight modifications:

"SECTION 8. *And be it further enacted*, That there shall be one commissary-general of subsistence; and there shall be as many assistant commissaries as the service may require, not exceeding fifty, who shall be taken from the subalterns of the line, and shall, in addition to their pay in the line, receive a sum not less than $10, nor more than $20, per month; and that assistant quartermasters and assistant commissaries of subsistence, shall be subject to duties in both departments, under the orders of the Secretary of War."

The foregoing resolution superseded so much of Section 6 of the Act of April 14, 1818, as related to the number and grades of officers in the Subsistence Department, and was a permanent enactment. The other provisions of Section 6, and Sections 7, 8, 9, and 10, of the Act of April 14, 1818, which were untouched by this legislation, retained their temporary character.

President Monroe, in his annual message to Congress, dated December 3, 1822, in referring to the new system of subsisting the Army, made the following suggestion:

"It appearing that so much of the act entitled 'An Act regulating the Staff of the Army,' which passed on the 14th of April, 1818, as relates to the commissariat, will expire in April next, and the practical operation of that department having evinced its great utility, the propriety of its renewal is submitted for your consideration."

On the 17th of December, 1822, Mr. Eustis, of Massachusetts, chairman of the Committee on Military Affairs, introduced a bill in the House of Representatives, to carry into effect the foregoing suggestion, which bill became a law on the 23d of January, 1823, in the following form:

"An Act to continue the present mode of supplying the Army of the United States.

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That the seventh, eighth, ninth and tenth sections of the act entitled, 'An Act regulating the Staff of the Army,' passed April fourteenth, eighteen hundred and eighteen, be, and the same are hereby, continued in force for the term of five years, and until the end of the next session of Congress thereafter."

On the 29th of April, 1826, the rank of brigadier-general, by brevet, was conferred on Colonel Gibson, the commissary-general of subsistence, under

the provisions of Section 4 of the Act of July 6, 1812, "for ten years' faithful service in one grade."

On the 9th of November, 1827, General Gibson addressed a letter to the Secretary of War, Hon. James Barbour, making the following recommendations: "Presuming that the utility of the present mode of subsisting the army to be sufficiently tested by eight years of successful experiment, I beg leave to suggest the expediency of asking Congress to make the department permanent.

"I am also induced to request your recommendation for a law authorizing the appointment of two majors to Commissariat Department, whose services are required to enable me more efficiently to conduct its operations."

Secretary Barbour made this letter an enclosure to his annual report for that year, with the following commendatory reference: "I beg leave, also, to recommend to the favorable consideration of Congress the alterations proposed by the commissary-general of subsistence, in the organization of the Subsistence Department, presuming that the mode of supplying the army by commissariat, whose advantages have been so satisfactorily manifested, will be continued by a new act of legislation, the former act being about to expire."

A bill in conformity with the foregoing recommendations was introduced in the House of Representatives, on the 2d of January, 1828, by Mr. Hamilton, of South Carolina, chairman of the Committee on Military Affairs. No further action, however, was taken on the bill until the next session of Congress, when it was taken up, and, after having been materially amended, was passed on the 2d of March, 1829, under the title of "An Act to continue the present mode of supplying the Army of the United States."

This act extended for an additional term of five years, and until the end of the next session of Congress thereafter, the provisions of the sixth seventh, eighth, ninth and tenth sections of the Act of April 14, 1818, temporarily establishing the commissariat system of subsisting the army, which had been similarly extended twice previously, and authorized the appointment of two commissaries of subsistence, to be taken from the line of the army, one with the same rank, pay and emoluments as a quartermaster, and the other with the same rank, pay and emoluments as an assistant-quartermaster.

The next legistation affecting the Subsistence Department was suggested by Hon. Lewis Cass, Secretary of War. In his annual report for 1833, he said:

"The act organizing the Subsistence Department expires by its own limitation on the 2d of March next. It was originally passed in 1818, and has been continued by successive temporary acts till the present time. The reason of this course of legislation is undoubtedly to be found in the fact that the introduction of this system was an experiment, and it was deemed prudent to test its operation before a permanent character was given to it. This has been fully done, and the result is, in every point of view, satisfactory. * * *

"I consider that the time has arrived when the present arrangement

should be rendered permanent, and I therefore present the subject with that view to your notice." * * *

On the 19th of December, 1833, Hon. Richard M. Johnson, of Kentucky, from the Committee on Military Affairs of the House of Representatives, introduced a bill "to render permanent the present mode of supplying the Army of the United States," which, after some preliminary action thereon, went over to the next session of Congress, when it was taken up and passed—becoming a law on the 3d of March, 1835.

A defect in the organization of the staff departments was brought to the attention of Congress by Hon. Benjamin F. Butler, of New York, Acting Secretary of War, in his annual report, dated December 3, 1836, which he described and commented upon as follows:

"The present system seems to have been formed upon the principle of concentrating the business of these departments at the seat of Government, and of employing therein a very small number of officers commissioned in the staff; the deficiencies being supplied by selections from the line. This arrangement is very well adapted to a time of profound peace, when officers can be spared from the line without injury to the service: when the positions of the troops are chiefly permanent; and when the changes which occur are made with so much deliberation as to afford ample time for preparing adequate means for transportation and supply; but when large bodies of troops whose numbers and movements may be varied by unforeseen contingencies, are to be supplied in the field, and at a great distance from the seat of Government, the system is worse than insufficient; it is the parent of confusion and delay. * * * To prevent inconveniences of this sort, it is evident that staff officers of experience and rank must be associated with the commander; and to supply such associates, the staff departments must be enlarged."

On the 8th of December, 1836, Hon. Thomas H. Benton, of Missouri, chairman of the Committee on Military Affairs, introduced a bill in the Senate "to increase the present Military Establishment of the United States, and for other purposes," which contained provisions based on the foregoing recommendation.

The bill was passed by the Senate on the 16th of February, 1837. It was taken up in the House of Representatives on the 3d of March, but on account of the proximity of the end of the session, was laid over, and not taken up again until the next session of Congress, when it was passed, and became a law on the 5th of July, 1838.

By Section 11 of this act, it was provided:

"That there be added to the commissariat of subsistence one assistant commissary-general of subsistence, with the rank, pay, and emoluments of a lieutenant-colonel of cavalry; one commissary of subsistence, with the rank, pay, and emoluments of a quartermaster of the army; and three commissaries of subsistence, with the rank, pay, and emoluments of assistant quartermasters."

The expansion of the Subsistence Department to the extent necessary to enable it to meet the requirements of the service in the war with Mexico, in 1846, was provided for by Section 5 of an act entitled "An Act supplemen-

tal to an act entitled 'An Act providing for the prosecution of the existing war between the United States and the Republic of Mexico," and for other purposes," approved June 18, 1846, which authorized the President, with the advice and consent of the Senate, to appoint as many additional officers as the service might require, not exceeding one commissary of subsistence with the rank of major for each brigade, and one assistant commissary of subsistence with the rank of captain for each regiment—the said additional officers to "continue in service only so long as their services shall be required in connection with the militia and volunteers."

On the 30th of May, 1848, Bvt. Brig.-Gen. Gibson, commissary-general of subsistence, was appointed a major-general, by brevet, "for meritorious conduct, particularly in performing his duties in prosecuting the war with Mexico."

On the 4th of January, 1850, Gen. Gibson addressed a letter to the Secretary of War, Hon. G. W. Crawford, requesting "that there be added to the Subsistence Department four commissaries of subsistence with the rank of captain, to be taken from the line of the Army."

In explanation of the necessity for this increase, Gen. Gibson said:

"The addition of Oregon, California, New Mexico and Texas to our territory compels me to ask for an increase in the number of officers in the Subsistence Department. Each of these commands requires the presence of an officer of the Commissariat, and from no point occupied by my officers can one be spared for these duties."

Gen. Gibson further explained that the necessity for the additional number of officers asked for was of a permanent character.

On the 30th of January, the Secretary of War transmitted copies of this letter to both branches of Congress, and recommended it to their favorable consideration. On the 26th of September, an act was passed, entitled "An Act to increase the commissariat of the United States Army," authorizing "That there be added to the subsistence department four commissaries of subsistence, with the rank of captain, to be taken from the line of the army."

The next legislation affecting the Subsistence Department was to facilitate its expansion to the extent necessary to meet the requirements for an increase in the Army of 500,000 men, provided for by the act entitled "An Act to authorize the employment of Volunteers to aid in enforcing the Laws and protecting Public Property," approved July 22, 1861.

This act provided that the forces to be raised thereunder should be organized into divisions and brigades; each division to consist of three or more brigades; each brigade of four or more regiments; and that each brigade, among other general-staff officers, should have "one commissary of subsistence."

By Section 2 of an act entitled "An Act for the better organization of the Military Establishment," approved August 3, 1861, the Subsistence Department was increased by the addition thereto of "four commissaries of subsistence, each with the rank, pay, and emoluments of a major of cavalry; eight commissaries of subsistence, each with the rank, pay, and emoluments of a captain of cavalry, and to be taken from the line of the army, either the volunteers or the regular army."

Gen. Gibson died on the 29th of September, 1861, after having served as commissary-general of subsistence forty-three years and five months.

Lieut.-Col. Joseph P. Taylor, assistant commissary-general of subsistence, was promoted commissary-general of subsistence with the rank of colonel, *vice* Gibson, deceased.

The 10th section of the act of July 17, 1862, entitled "An Act to amend the Act calling forth the militia to execute the laws of the Union, suppress insurrection, and repel invasion, approved February 28, 1796, and the Act amendatory thereof, and for other purposes," authorized the President "to establish and organize army corps, according to his discretion." The 10th section of the same act prescribed the staff of the commander of an army corps, and allowed to him, among other general staff officers, one commissary of subsistence with the rank of lieutenant-colonel, to be assigned by the President from the regular army or the volunteers.

By the following act, approved February 9, 1863, the Subsistence Department was given a stronger and more symmetrical organization, better adapted to the exigencies of war:

"An act to promote the efficiency of the Commissary Department.

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That there be added to the subsistence department of the army one brigadier-general, to be selected from the subsistence department, who shall be commissary-general of subsistence, and, by regular promotion, one colonel, one lieutenant-colonel, and two majors; the colonels and lieutenant-colonels to be assistant commissaries-general of subsistence, and that vacancies in the above-mentioned grades shall be filled by regular promotions in said department; and the vacancies created by promotions herein authorized may be filled by selections from the officers of the regular or volunteer force."

Under the provisions of the foregoing act, Col. Joseph P. Taylor, commissary-general of subsistence, was appointed commissary-general of subsistence, with the rank of brigadier-general.

On the 29th of June, 1864, Gen. Taylor died, after having served as an officer of the Subsistence Department thirty-five years, and as its chief nearly three years in the most eventful period of its existence.

Col. Amos B. Eaton, the senior assistant commissary-general of subsistence, was appointed the successor of Gen. Taylor.

The War of the Rebellion closed in 1865. The magnitude of the operations of the Subsistence Department during the four years of that war, is indicated by the following table, showing the amount of its disbursements for each year, and the total amount thereof:

From July 1, 1861, to June 30, 1862	$48,799,521.14
From July 1, 1862, to June 30, 1863	69,537,582.78
From July 1, 1863, to June 30, 1864	98,666,918.50
From July 1, 1864, to June 30, 1865	144,782,969.41
Total	$361,786,991.83

When the war closed there were in service of the Subsistence Depart-

ment the 29 officers constituting the permanent establishment, and 535 commissaries of volunteers, making a total of 564 officers.

In referring to the operations of the Subsistence Department, in his annual report for 1865, Hon. Edwin M. Stanton, Secretary of War, said:

"During the war this branch of the service never failed. It answers to the demand, and is ever ready to meet the national call."

The act of July 28, 1866, entitled "An Act to increase and fix the Military Peace Establishment of the United States," contained the following provisions fixing the organization of the Subsistence Department, and enlarging its province.

"SECTION 16. *And be it further enacted*, That the subsistence department of the army shall hereafter consist of the number of officers now authorized by law, viz.: one commissary-general of subsistence, with the rank, pay, and emoluments of a brigadier-general; two assistant commissaries-general of subsistence, with the rank, pay, and emoluments of colonels of cavalry; two assistant commissaries-general of subsistence, with the rank, pay, and emoluments of lieutenant-colonels of cavalry; eight commissaries of subsistence, with the rank, pay, and emoluments of majors of cavalry; and sixteen commissaries of subsistence, with the rank, pay, and emoluments of captains of cavalry."

"SECTION 23. *And be it further enacted*, That the adjutant-general, quartermaster-general, commissary-general of subsistence, surgeon-general, paymaster-general, chief of engineers, and chief of ordnance shall hereafter be appointed by selection from the corps to which they belong."

"SECTION 25. *And be it further enacted*, That the office of sutler in the army and at military posts is hereby abolished, and the subsistence department is hereby authorized and required to furnish such articles as may from time to time be designated by the inspector-general of the army, the same to be sold to officers and enlisted men at cost prices, and if not paid for when purchased a true account thereof shall be kept and the amount due the government shall be deducted by the paymaster at the payment next following such purchase: *Provided*, That this section shall not go into effect until the first day of July, eighteen hundred and sixty-seven."

Section 16, above quoted, was a codification of all existing laws relating to the personnel of the Subsistence Department, except the provision of Section 8 of the act of March 2, 1821, authorizing not exceeding fifty assistant commissaries of subsistence, to be taken from the subalterns of the line, which, therefore, fell under the operation of the repealing clause.

By Section 24 of the Army-appropriation act, approved July 15, 1870, it was provided that the pay of an acting assistant commissary of subsistence should be one hundred dollars per annum, in addition to the pay of his rank.

The office of acting assistant commissary of subsistence was not authorized by a general law, but was maintained under a provision annually re-enacted in the army-appropriation acts.

General Eaton, "having served faithfully more than forty-five years," was retired from active service, under the provisions of Section 12 of the act of July 17, 1862, by a general order issued on the 16th of February, 1874, to take effect on the 1st of May following.

General Eaton was granted a leave of absence from the date of the above-mentioned order until the date of his retirement, and Col. Alexander E. Shiras, the senior assistant commissary-general of subsistence, was designated to perform the duties of commissary-general of subsistence, and ordered to relieve General Eaton. Colonel Shiras performed the duties of commissary-general of subsistence until the date of General Eaton's retirement, and, thereafter, until the removal of the bar to promotions and appointments in the Subsistence Department and other staff corps and departments imposed by Section 6 of the Army-appropriation act of March 3, 1869.

By Section 3 of the Act of June 23, 1874, entitled "An Act to reorganize the several Staff Corps of the Army," the number of assistant commissaries general of subsistence with the rank of lieutenant-colonel, was increased from two to three, and the number of commissaries of subsistence with the rank of captain, was reduced from sixteen to twelve.

Section 8 of the above-mentioned act repealed so much of Section 6 of the Army-appropriation act of March 3, 1869, as prohibited promotions and appointments in the Ordnance, Subsistence and Medical Departments, and Col. Shiras was then appointed commissary-general of subsistence, *vice* Eaton, retired.

Gen. Shiras died on the 14th of April, 1875, and was succeeded by Maj. Robert Macfeely, commissary of subsistence.

The office of "acting assistant commissary of subsistence" expired with the Army-appropriation act for the fiscal year ending June 30, 1882, and was superseded by the office of "acting commissary of subsistence," which was provided for by the Army-appropriation act approved July 5, 1882, and has since been continued by annual reënactments.

Gen. Macfeely served as commissary-general of subsistence until July 1, 1890, when, having reached the age of sixty-four years, he was retired from active service under the operation of the first section of the Act of June 30, 1882.

Col. Beekman Du Barry, the senior assistant commissary-general of subsistence, succeeded Gen. Macfeely, and upon his retirement from active service in December, 1892, was succeeded by Col. John P. Hawkins, the present commissary-general of subsistence.

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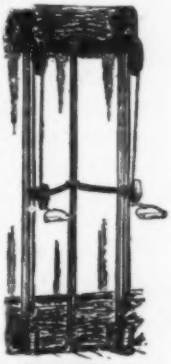

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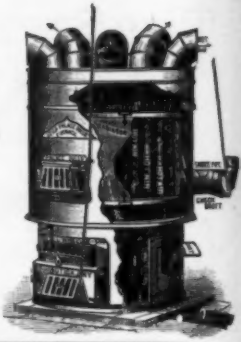

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